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DENT'S HISTORICAL
AND ECONOMIC GEOGRAPHIES

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GREAT BRITAIN AND IRELAND

ILLUSTRATED

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PREFACE

Great Britain and Ireland is the third volume of Dent's "Historical and Economic Geographies." The events of the past eight years have not only delayed the publication of new books in this series, but have changed many of the geographical facts with which they are concerned.

Every effort has been made in the preparation of this volume to take account of these changes, which are necessarily largely economic in character, and have become historical; and thus must take their place in a treatment which expressly stresses these two important aspects of geography.

The economic condition of Great Britain and Ireland is the result of a long process of development. To understand the present and to grasp something of the trend of future movement the past must be surveyed. This has been attempted, not as historical fragments imported into geography, but as an integral part of the geographical development of Great Britain and Ireland. Such a study of geography should make for a more enlightened and intelligent understanding of national affairs and their development than has hitherto been possible.

This book should prove especially valuable in those schools where individual work is a feature of the system of education.

H. P.
1922. R. J. F.

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GREAT BRITAIN AND IRELAND

I.—GENERAL SURVEY

CHAPTER I

BRITISH LANDS AND SEAS

The British Isles stand, as it were, knee-deep in the shallow water off the coast of Western Europe. They form an archipelago of some 5000 islands which are the elevated portions of the continental shelf of Western Europe, and are thus essentially a part of the European Continent.

This continental shelf is an extension of the Continent under water. Its edge is marked by the 100-fathom line, beyond which there is a sharp descent to the ocean depths of the Atlantic. It suggests that in past ages part of Western Europe underwent a gradual subsidence which allowed the ocean to encroach upon the old land-surface that now forms the bed of the British seas.

To-day, at the Straits of Dover, Britain is within twenty-two miles of the Continent. If the continental shelf on which it stands were raised 300 feet, Britain would become once more part of the Continent, as it was long ago. The similarity of the rocks of Scotland and Norway, of the Fen District and Holland, of the chalk cliffs of Dover and Calais, and of Cornwall and

FIG. I.—GREAT BRITAIN AND IRELAND ON THE CONTINENTAL SHELF

Brittany, leaves no room for doubt of the old land-connection between the British Isles and the Continent.

British Seas.—British seas are shallow. The North Sea is so shallow that if it were possible to set St. Paul's Cathedral in it, almost anywhere the whole of the dome would be above water. Its shallowest part is the Dogger Bank, which rises to within about ten fathoms of the surface; so does the Varne Bank

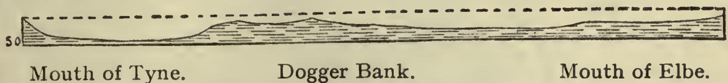

FIG. 2.—SECTION ACROSS THE NORTH SEA FROM NEWCASTLE-ON-TYNE TO THE MOUTH OF THE ELBE.

in Dover Straits. In the north-east, close to the Norwegian coast, however, is a deep submarine gulf, known as the Norway Deep, which in places exceeds 400 fathoms.

Between Great Britain and Ireland runs a deep trench, closer to Ireland than to Great Britain, whose depth exceeds fifty fathoms for almost its entire length. In the North Channel, between Scotland and Ireland, are "pits" over 100 fathoms in depth.

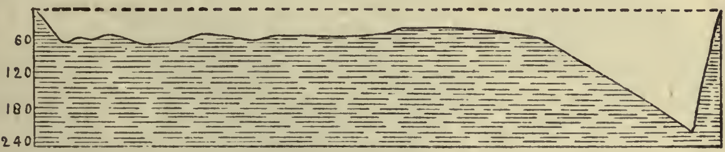

FIG. 3.—SECTION ACROSS THE NORTH SEA FROM BUCHAN NESS TO THE NAZE

These shallow seas which surround the British Isles are of great importance. Shallow water is warmer than deep water. Shallow water is the home of millions of edible fishes, which swarm there to feed upon the multitudes of tiny creatures which live in the shallows. The North Sea, especially the Dogger Bank, the Great Fisher Bank and the Long Forties, stands easily first among British fishing grounds. In a normal year the North Sea alone yields about half our supply of fish.

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FIG. 4.—CO-TIDAL LINES

Tides in British Seas.—More important still is the effect of the shallow British seas upon the tides, which twice a day come sweeping into British estuaries, bearing the merchant ships of the world upon their flood.

In the open ocean the tidal effect is to raise the water-level a foot or so. But when the tidal wave approaches British shores it is retarded by the continental shelf, and the water heaps up, as it were, and sets up very definite tidal currents among the islands.

This piling up of tidal water is particularly noticeable in funnel-shaped estuaries like the Bristol Channel—Severn estuary, when there is often as much as sixty feet difference between high-water and low-water levels. Here the piled-up water at last rushes forward like a low wall, from one to two feet above the level of the river Severn. The bore or *eagre* of the Trent is another example.

The tidal wave approaches the British Isles from the south-west. It branches into three—one branch proceeding up the English Channel, another up St. George's Channel into the Irish Sea, and the third passing northward along the west coast of Ireland and Scotland, and round northern Scotland into the North Sea, where it moves southward on the flood. As this northern branch speeds northward it sends off a branch tide through the North Channel into the Irish Sea, to arrive there about the same time as the tide via St. George's Channel. This double tidal effect is of great importance to Liverpool and its sea approaches, enabling very large ships to cross the Mersey Bar on the flood tide.

London and Southampton.—The tides contribute very largely to the importance of the Port of London.

The northern tide, which has passed round the north of Scotland, sweeps into the Thames estuary at about the same time as a new tide through the English Channel—twelve hours younger than the northern tide—creating a double tidal effect. The tidal water pushes back the normal flow of the river and creates a strong tidal current which passes up the river as far as Teddington. This enables large vessels to pass up-stream and to enter the docks, where the water is maintained at its level by the closed lock-gates when the tide in the outer river ebbs.

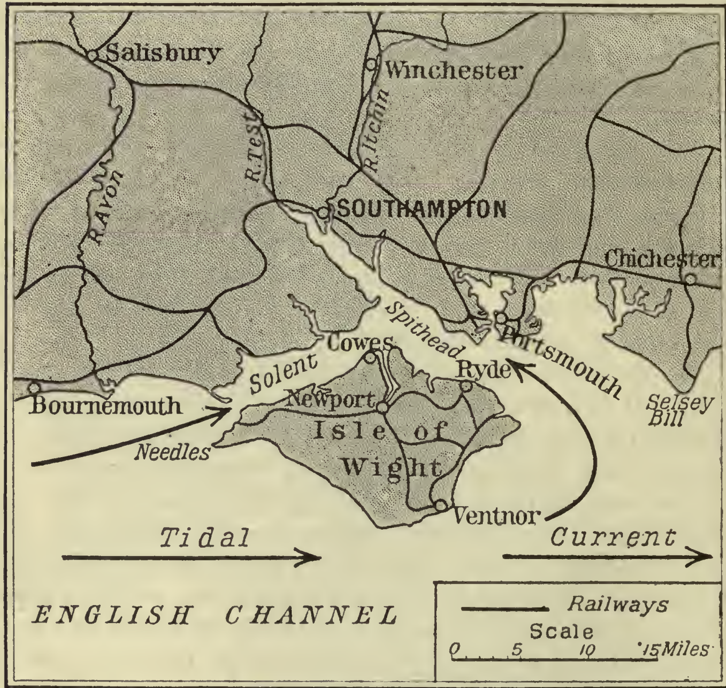

FIG. 5.—THE SOUTHAMPTON TIDES

Thames ebb runs longer than Thames flood, because of the pressure of the normal seaward flow of the river.

Thus, in the lower Thames, there is a strong current flowing down-stream at ebb-tide, and a strong current flowing up-stream during flood-tide, enabling lighters to move up or down the river with no other motive power than the tidal current.

Southampton, too, enjoys special advantages due to local tidal peculiarities. In Southampton Water the tide flows twice every twelve hours, instead of once, so that ebb is never complete and the harbour never has very low water. The advancing up-Channel tidal wave sends a tide through the Solent and up Southampton Water, while the main tide presses on south of the Isle of Wight. But just as the Solent tide is ebbing a new tide enters by way of Spithead, maintaining high water much longer. Spithead tide is about two hours later than Solent tide.

Southampton's tidal advantage means that large vessels can enter harbour at any state of the tide.

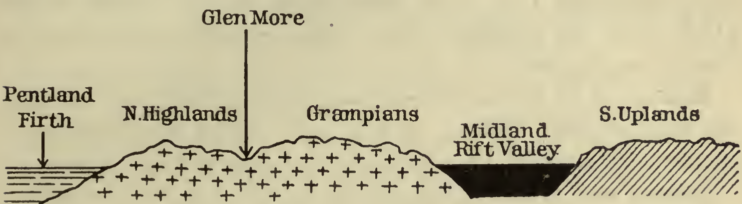

FIG. 6.—SECTION ACROSS SCOTLAND

Surface Relief

A first glance at the orographical map reveals these facts:

(1) Scotland has the greatest proportion of land over 1000 feet.

(2) England has the greatest proportion of lowland (under 600 feet).

(3) Ireland's highlands lie in separate masses around the coast, the highest in the south-west. The middle of the island is mainly a plain under 600 feet elevation.

Let us look more closely at the map, and see how the highlands and lowlands are arranged.

Scotland.—Scotland falls into three main physical divisions:

(1) The *Highlands*, cleft in two by the narrow rift of Glen More, whose lakes and rivers have been linked and canalised to form the Caledonian Canal.

(2) The *Lowlands*, or Midland Valley, which has, however, ridges exceeding 2000 feet in height.
(3) The *Southern Uplands*, which form part of the Anglo-Scottish borderlands.

The *Highlands* have the greatest average elevation; many peaks exceed 3000 feet. *Ben Nevis*, the highest mountain in the British Isles, rises to 4406 feet—within a few hundred feet of the snow-line. The *Southern Uplands* nowhere reach 3000 feet.

The *Lowlands* are the result of a subsidence of the land between two long parallel series of faults—the northern line of fault extending from near Stonehaven to the mouth of the Clyde, and the southern from Girvan on the south-west to Dunbar on the east.

Because of its origin the Scottish Midland Valley is known as the Scottish Rift Valley. It has been formed by a portion of earth-crust being let down between two parallel lines of fault.

England and Wales.—Outstanding surface features of England and Wales are:

(1) The highlands all lie west of a line drawn from Flamborough Head to Portland Bill.
(2) The northern highland system consists of the Cheviots, the Pennines and the English Lake District. The mountains of the Lake District are linked with the Pennines by the "saddle" of Shap Fell, across which the Midland and London and North Western railways climb from Lancashire to the Eden Valley and Carlisle.
(3) The western highlands are the Welsh mountains, which fill the greater part of the Principality.
(4) The south-western highlands consist of the much worn-down mountains of Devon and Cornwall.
(5) The south-eastern lowlands, consisting of the Midland Plain and the Scarplands of south-east England. The lowest and flattest part of this region is the Fen District around the Wash, where *dikes* keep out the sea.

The highest peak in England is *Scafell Pike* (3210 feet). In Wales *Snowdon* rises to 3571 feet.

Ireland.—The map of Ireland has the following main features:

(1) A northern system of detached highland masses.
(2) A southern system, higher and less detached in the south-west.
(3) A western system of detached masses.
(4) The Central Plain, which is really a continuation of the English Midland Plain—itself a continuation of the Great Plain of Middle Europe.

The highest peaks are in the south-west, where Macgillycuddy's Reeks rise to 3414 feet in *Carrantuohill.*

Details of surface relief will be found in the pages devoted to the study of individual regions.

British Rivers.—Since the general slope of Great Britain is from west to east, the longest rivers flow to the North Sea, save for two important exceptions—the Severn and the Clyde. Ireland's rivers drain from the central plain to the seas through gaps between the detached mountain masses around the coast-line.

The *Shannon* is the longest British river. It is remarkable for the lakes in its course, which are really expansions of the river. Its source in the hills near Lake Allen is only about 170 feet above sea-level, so that its course is nearly everywhere sluggish and winding. But between Lake Dearg and Limerick the Shannon has sawn a valley through the gorge of Killaloe, where a series of small rapids is quite serious enough to hinder navigation, and a canal has been cut to avoid it. In any case traffic on the Shannon is not heavy, for the river flows through a scantily-populated area, and enters the sea on the opposite side of Ireland to Great Britain, with which the bulk of Ireland's trade is carried on.

The *Thames* and the *Mersey* are of greatest commercial importance. The *Clyde* is Scotland's most important river; it has been made so by dredging. Some Scotsmen still living can remember when it was possible to cross the Clyde at Glasgow by stepping stones.

Many British streams of no commercial importance, especially in the mountainous areas, are noteworthy because their valleys afford natural routes for road and railway traffic. Trace the railways of mid-Wales, or the Trans-Pennine railways, or the Scottish railways on an orographical map, and notice how frequently the lines make use of river-valleys and river-gaps.

English river-systems are linked by a network of canals, roughly in the form of an X, connecting Humber, Severn, Mersey

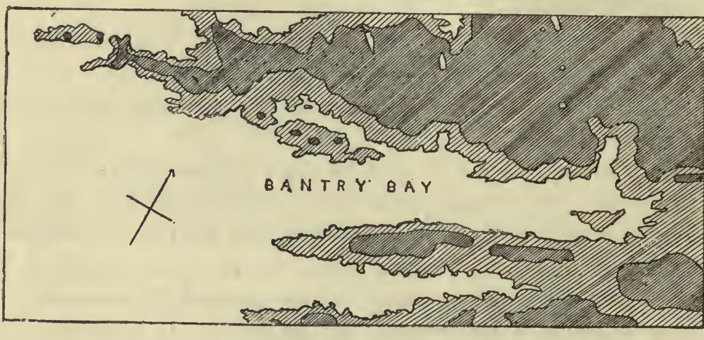

FIG. 7.—THE RIAS OF BANTRY BAY AND DUNMANUS BAY, IRELAND

and Thames, with the intersection of the arms (and many branches) at the great industrial areas of the English Midlands. If these canals were of standard gauge, and under one control, they might play as great a part in British inland transport as French canals do in France, or Belgian canals in Belgium. (See Chap. XI, and Map, p. 120.)

Study the orographical map, locate the chief rivers, and follow the course of each, so that when we come to deal with their basins in the detailed regional surveys which follow, they will be familiar.

Coastal Features.—The British Isles have a much-indented coast-line, which affords abundance of splendid harbours.

Western Scotland, with its long winding sea-lochs and fringing islands, reminds us of Norway and its fjords. Both lochs and fjords owe their origin to (1) the sculpture of deep valleys by moving ice and rivers, and (2) the gradual subsidence of the coast-line which has allowed the sea to drown the valleys, forming islands of outstanding masses of higher land.

The wide estuaries of the east coast—the Tay, Forth, Humber, and Thames—are the drowned seaward ends of river-valleys. So are the *rias* of south-western Ireland—Dingle Bay, Kenmare River and Bantry Bay, and of the south-western peninsula—Plymouth Sound and Falmouth Harbour. The character of the coast-line varies considerably—generally on

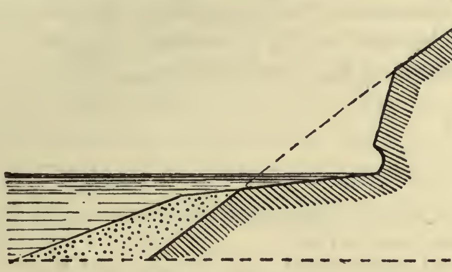

FIG. 8.—FORMATION OF CLIFFS

Dotted line shows part cut away; note well-developed coast-platform.

account of the age and structure of the rocks. High, bold, rocky coast-lines occur where the older and harder rocks come to the sea. Examples occur all along Western Scotland and Ireland, in Wales and in Cornwall. Steep chalk cliffs occur on the south and east where the chalk ridges reach the sea. The waves have cut back the chalk into cliffs. Flamborough Head, Hunstanton Point, and Beachy Head are noted examples.

The younger, softer rocks—the clays and sands—result in low coast-lines with fringing sands and mud flats, as in Essex, and in the region of the Fens. The sands of the Wash and the mudbanks and sands of the Thames estuary are really the sub-marine deltas of the rivers. They consist of the silt brought down by the rivers themselves. In the Thames estuary an elaborate system of lightships, lighthouses, and buoys is necessary to mark the navigable channels, of which the chief are the Swin, the Black Deep, and the Edinburgh and Prince's channels.

Dungeness, Orfordness and Chesil Beach are examples of "groyne capes." In these cases the tidal currents that sweep up and down the coasts have built up capes of shingle much as sand accumulates behind groynes on a threatened foreshore. Spurn Head is of similar type.

The Scilly Isles are part of an old land—the fabled Lyonesse—which has foundered in fairly recent times. In East Suffolk, subsidence of the coast-line is still going on, for the sea is gaining on the land. Dunwich, a thriving port in the Middle Ages with fifty-two churches and a big population, is now a tiny fishing village. The old town lies beneath the sea.

QUESTIONS AND EXERCISES

1. Draw sketch maps of the British Isles as they would appear
   (*a*) If the land rose 600 feet.
   (*b*) If the land sank 600 feet.

2. Draw a sketch map of the North Sea, marking the Dogger Bank, the British fishing-ports of Hull, Grimsby and Aberdeen, and the Port of London.

3. Explain the tidal advantages of London, Liverpool, and Southampton.

4. Draw rough sections to scale along lines joining (*a*) Galway and Hamburg; (*b*) Aberystwyth and Lowestoft.

5. Show the following facts graphically by constructing a suitable diagram.

England	50,874 square miles.
Wales	7,466 ,, ,,
Scotland	30,405 ,, ,,
Ireland	32,586 ,, ,,

6. Into what physical divisions would you divide Scotland? Why? Draw a rough section from north to south to illustrate your answer.

7. Explain the causes of (*a*) the Irish bogs, (*b*) the difference in characteristic scenery of Wales and the Fen District.

CHAPTER II

ROCKS AND THEIR MINERAL WEALTH

In order to understand how the British Isles have become a great manufacturing country, it will be necessary for us to know something about their rock-structure. The character and arrangement of the rocks explain why certain industries are carried on in certain places—for if we trace anything we use back to its very beginnings, we come eventually to the rocks.

Geology and Surface Relief.—The geological map throws considerable light upon the surface relief of the British Isles, as well as upon their past physical history. The simplified geological map on p. 14 is a little complicated, but it reveals the following important facts:

(1) *A great number of rocks of varying character and age come to the surface.*

This is mainly the result of the alternate elevation and subsidence, and consequent crumpling and folding of the rocks, which have made accessible the rich deposits of minerals that form the basis of British manufacturing industry.

(2) *The oldest and hardest rocks lie to the north and west. The youngest and softest rocks lie generally to the south-east.*

In the north and west are gneiss—a very ancient and much altered rock—granites and other igneous rocks, old hard sandstones and limestones. Many of these are so pressed and altered that they are crystalline in texture. Here, too, are slates formed by great pressure from ancient clays and shales.

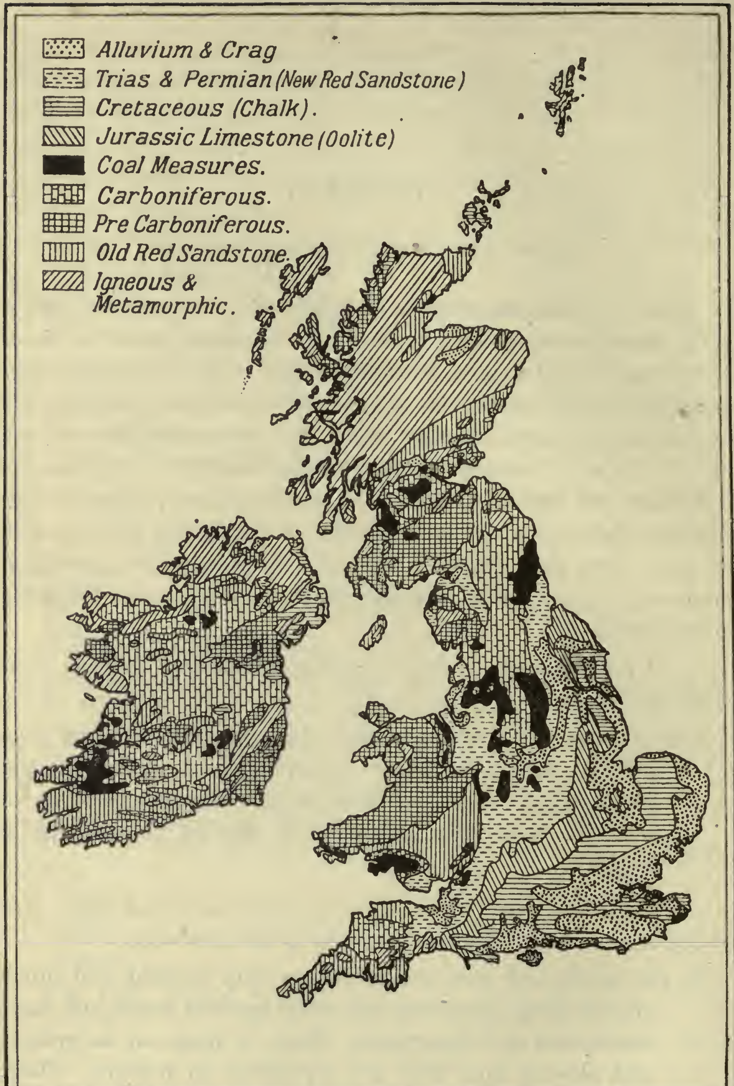

FIG. 9.—GEOLOGICAL MAP (Simplified)

In the south-east, however, are soft limestones like the oolite and the chalk, and sands and clays which easily weather into the ridges, rounded hills and vales characteristic of south-east England.

The old hard rocks of north and west are weather-resistant and in spite of their age still form the highlands of Britain where uplifts in past ages have reared them. Similar old hard rocks lie beneath the younger and softer strata of the south-east, as is proved in deep boring for water and coal.

(3) *The ancient rocks of the Southern Uplands of Scotland are continued across the North Channel into Northern Ireland.*

The same rocks occur also in the Lake District and the Isle of Man. Note, too, that the mountains of Wales are of much the same material as those of Wicklow. This grouping of rocks around the Irish Sea suggests not only a former land connection between Great Britain and Ireland, but the origin of the Irish Sea in a series of fault-basins flooded by the ocean.

(4) *Scotland consists almost entirely of old rocks. The oldest (in the north) reappear in Ireland in the mountains of Donegal.*

The rock-structure largely accounts for the barren highland character of these regions, and their consequent scanty population. Here and there granite masses rear their humps above the old rocks through which they forced their way, ages ago, in a semi-molten state. The granites of Aberdeen and of Donegal are in great demand as building stones.

(5) *Ireland consists mainly of a great limestone plain surrounded by detached uplands of harder rocks.*

This limestone plain was once covered by the coal measures, of which only very small portions remain. Hence Ireland is an agricultural, rather than a manufacturing country.

The Irish bogs of the Central Plain have resulted from the growth and decay of generations of sphagnum moss and marsh plants in the shallow flooded hollows of the limestone, where accumulations of boulder clay deposited by prehistoric glaciers held up the water.

Other geological features which help to explain the geographical conditions of to-day will be dealt with in their proper places.

Mineral Resources.—Foremost among Britain's resources come the vast deposits of coal and iron which form the basis of her manufacturing industries and the chief source of her wealth. Besides coal and iron, Britain has valuable deposits of salt, copper, tin and lead; zinc, silver, gold, aluminium, clay, oilshale, and building stone; rarer metals like tungsten; and pitchblende from which radium is extracted. Petroleum also occurs.

Metal ores occur chiefly in old hard rocks in "lodes" or veins which may be anything from an inch or two to several yards in thickness. Tin, lead, copper, and zinc are found in this way. Iron, however, is frequently found in bedded deposits which suggest that it has been deposited from solution in water. The clay ironstones of the coal measures, and the iron of the Cleveland district of North-east Yorkshire (the most important of British iron-fields) are of this type. Another valuable iron ore is hæmatite, which occurs in "pockets" in the old limestones of Cumberland and South Wales especially. Limonite is vein-iron; it occurs in veins like lead or zinc—often in the same rock masses as these metals.

Coal.—*Coal* is found in the coal measures—part of a great system of old rocks known as the carboniferous system, because it includes coal deposits. This system includes (1) carboniferous limestone, (2) the millstone grit, and (3) the coal measures, which are not all coal but consist of alternate beds of sandstone, clay, coal and ironstone. Above each coal seam occurs a bed of sandstone, called by miners "the roof of the coal." Below the coal seam is the "under clay"—a deposit which seems to have been the soil in which grew many of the trees and plants whose fossil remains form the coal.

Ages ago the coal measures lay spread over the whole of Britain. When crustal movements threw the carboniferous system into huge folds, some of the coal was upthrust to be planed off by denudation; and some was thrust down to be protected from weathering in a sort of basin.

A section across the Pennines shows what has happened when up-folds occurred. Originally the limestone, grit, and coal measures were horizontal. When the Pennine up-fold occurred, and these strata were thrown into an arch or "anticline," the crest of the arch was worn away, leaving the coal measures on its

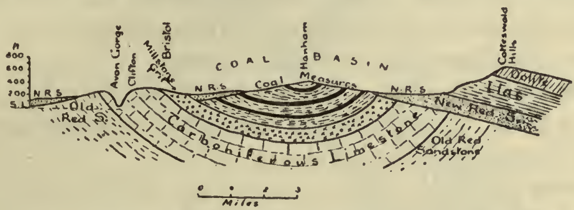

FIG. 10.—SECTION ACROSS BRISTOL COALFIELD
(After Dr. Morley Davies)

flanks to be partly covered by the younger horizontally bedded New Red Sandstone.

The section in Fig. 10 shows what resulted when the rocks of the carboniferous system were down-folded into a basin or trough ("syncline"). At the bottom of the basin is the limestone; next the millstone grit; and then the coal measures partly overlain by the New Red Sandstone.

In many coalfields the basin-like arrangement occurs, the coal coming to the surface ("out-cropping") around or towards the margin of the basin.

Coal seams vary from a few inches to several yards in thickness. The "Thick Coal" of the South Staffordshire coalfield is in many places 30 feet in thickness. In America and China there are seams over 120 feet thick.

The four main kinds of British coal are:

(1) *Lignite* or brown coal, a poor kind for heating and which is not much mined in Britain.

(2) *Cannel* coal ("candle"), which is highly gaseous, and used for making gas. It does not soil the fingers.

(3) *Bituminous* coal, very black, and used for household and commercial purposes.

(4) *Anthracite* or "stone coal"—very hard, clean to handle, and difficult to light. Gives out great heat with little smoke or flame.

Sometimes more than one sort of coal occurs on the same coalfield. The great South Wales coalfield, for example, has anthracite in the north-west, partly-bituminous coal in the centre, and true bituminous coal in the south-east.

British Coalfields.—Great Britain is rich in coal; but Ireland has very little. Great Britain is mainly a manufacturing island; Ireland mainly an agricultural one.

The map shows the distribution of the chief coalfields of the British Isles. They fall into groups which are easily remembered as follows:

I. *Scottish Coalfields of the Midland Valley.*

1. Ayrshire coalfield.
2. Lanark coalfield.
3. Firth of Forth coalfields (including the Fife, Lothian, and Clackmannan fields).

II. *Coalfields of the Pennine Flanks.*

1. Northumberland and Durham coalfield.
2. Yorkshire, Derbyshire and Nottinghamshire coalfield.
3. North Staffordshire coalfield.
4. South Lancashire coalfield.
5. Cumberland coalfield.

III. *Coalfields of Welsh Borders.*

1. Flint and Denbigh coalfield.

FIG. II.—REGIONS OF THE COAL MEASURES

[NOTE.—The coal formations south of the Shannon mouth are poor in coal and hardly worth working.]

2 Mid-Severn coalfield.
3. Forest of Dean coalfield.
4. South Wales coalfield.
5. Bristol coalfield.

IV. *Midland Coalfields.*
1. South Staffordshire coalfield
2. Warwickshire coalfield.
3. Leicestershire coalfield.

V. *Kent Coalfield.*

VI. *Irish Coalfields.*
1. Ballycastle coalfield in N.E. Antrim.
2. Tyrone or Coalisland coalfield.
3. Kilkenny or Leinster coalfield.
4. Lough Allen or Arigna coalfield.
5. Tipperary coalfield.

The biggest producer is the Yorkshire, Derbyshire and Nottinghamshire coalfield. Next comes the Northumberland and Durham, and third the South Wales coalfield.

The British Isles are not only rich in coal and iron, but in the distribution of these minerals they enjoy advantages which do not fall to the lot of every country that has abundance of these valuable deposits.

1. All British coalfields are near the sea. Several are actually on the sea-coast. This facilitates (*a*) the export of the coal; (*b*) the import of raw materials for manufacture; (*c*) the export of the manufactured products.
2. In many cases the iron occurs with the coal, or near it; with the consequent saving of time and money that would otherwise have to be spent in transport.

The map on p. 21 shows where the chief deposits of iron occur. Compare it with the map of the coalfields and draw important conclusions.

Importance of Coal.—Coal-mining is in itself an important

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FIG. 12.—DISTRIBUTION OF METAL ORES

industry and employs about a million and a quarter hands. Coal is the life of many other industries, which depend upon it as a source of power, light and heat in their various processes.

Where iron is smelted, much *coke* is needed for the blast furnaces, and there are many "coking-plants" in which coke is made by heating the coal in closed ovens, and in which special provision is made for collecting the *gas*, *ammonia*, *tar* and other important by-products. Coal-tar in itself yields a wonderful range of valuable products—*aniline dyes*, *benzol*, *naphtha*, *creosote*, etc.

Salt.—Salt is usually found in rocks younger than the coal measures, but older than the chalk and oolite. The biggest deposits occur in what is called the Keuper Marl, and are mined in Cheshire, Lancashire, Staffordshire, Worcestershire, Yorkshire and Durham. Ireland has deposits in Antrim.

Deep bores are made into the salt, and down them water is allowed to flow so that the salt-mine is flooded with what soon becomes a subterranean lake of brine. The brine is pumped up and the salt recovered by evaporation. Salt-mines obviously cannot be "propped" like coal-mines, and their "roofs" often give way, leaving evidences of the subsidence on the surface. In some salt towns and villages houses have sunk so that the only way in is through the top floor windows; in others the houses lean in various directions.

Salt gives rise to important chemical industries. It is used in making bleaching powder, washing soda, hydrochloric acid, and caustic soda. Brine from Cheshire is pumped along pipe lines to chemical works along the banks of the Manchester Ship Canal, where the washing soda and bleaching powder are made for use in the cotton-spinning mills of South Lancashire.

QUESTIONS AND EXERCISES

1. The map on p. 21 shows the distribution of the chief deposits of metal ores. Locate them on a good map, and find the names of the principal centres.

2. Draw a simple diagram embodying the outstanding facts of the following table of coal production in Great Britain:

Area.	Tons raised, February, 1921.
Scotland	2,561,000
Northumberland . . .	751,000
Durham	2,328,000
South Wales and Monmouth .	2,707,000
Cumberland and Westmorland .	133,000
Yorkshire	2,967,000
Lancashire, Cheshire and North Wales	1,684,000
Nottingham, Derby and Leicester	2,320,000
Stafford, Shropshire, Worcester and Warwick . . .	1,455,000
Other areas including Gloucester, Somerset and Kent . .	220,000
Total for Great Britain . .	17,126,000

Write a short account of British coal production as shown in the above table.

3. "Coal is the mother of industry and of population." Explain and illustrate this statement in regard to Great Britain and Ireland.

4. The following table gives figures for the *export* of coal, coke and manufactured fuel from British ports in 1915.

Ports.	100,000 Tons.
Cardiff . .	110
Tyne Ports .	88
Swansea . .	38
Newport . .	35
Sunderland .	25
Glasgow . .	24
Hull . .	24
Blyth . .	23
Port Talbot .	16
Methil . .	14
Leith . .	12
Hartlepool .	9
Burntisland .	9
Grimsby . .	8

Locate the ports. Group them according to the coalfields they serve. Estimate the order of importance of British coalfields from the point of view of coal export.

5. The following table gives the coal production of the various counties for 1915.

	County.	Tons of Coal.
England	Yorkshire	40,358,000
	Durham	33,738,000
	Lancashire	21,406,000
	Derbyshire	16,652,000
	Monmouthshire	14,225,000
	Staffordshire	13,353,000
	Nottinghamshire	11,801,000
	Northumberland	11,041,000
	Other English Counties	15,482,000
Wales	Glamorgan	33,110,000
	Other Welsh Counties	6,359,000
Scotland	Lanarkshire	15,394,000
	Other Scottish Counties	20,203,000
	Ireland	85,000

Examine the table carefully. Group the counties into "fields," and estimate the yield of the great British coalfields.

What do you learn on comparing your results with those obtained in the former exercise?

CHAPTER III

CLIMATE

The climate of any region is its average weather conditions, and depends in the main upon the average amount of heat and moisture the region receives during the year.

Climate very largely rules the destinies of nations. The white man has become master of most of the world because the climatic conditions in which he lives stimulate energy and enterprise, and call forth the best that is in him. He has developed physical and mental efficiency to a degree beyond that possessed by other races because he dwells in lands where the climate is ideal for human life—where temperature ranges from 39° F. to 66° F. It is significant that London's January mean temperature is 38° F., and its July mean temperature 63° F. Britain's greatness is very largely due to her climate, which is the result of her favourable situation on the eastern side of the Atlantic in the Cool Temperate Belt.

Britain's Climatic Advantages.—Britain's climatic advantages are:

(1) *No great range of temperature.* Neither summer heat nor winter cold is excessive. Winters are cold enough to stimulate and energise. Summers are rarely hot enough to enervate man and hinder industry.

(2) *Abundance of rainfall*, enabling agriculture and stock-rearing to be profitably carried on wherever the soil permits.

(3) *Winter cold is never severe enough to seal our harbours with ice*, and so cut off our overseas trade for part of the year. Yet Canada and the Baltic, in the same latitude as

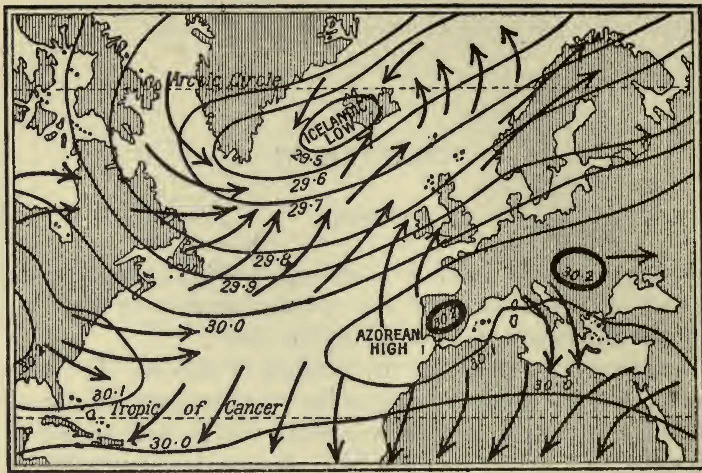

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FIG. 13.—JANUARY

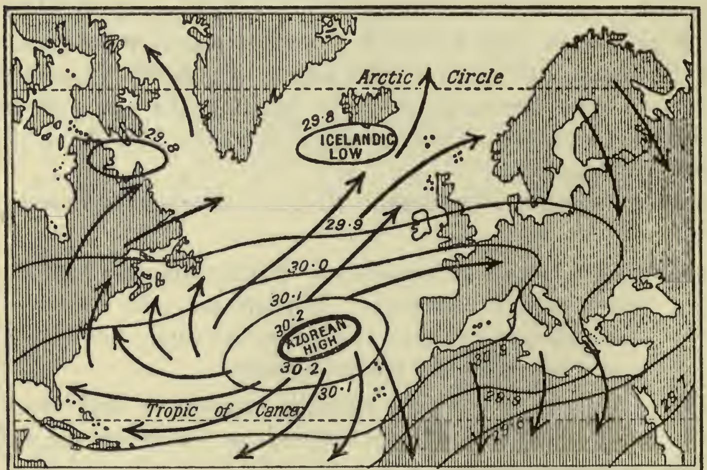

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FIG. 14.—JULY

AZOREAN HIGH AND ICELANDIC LOW

Britain, have their ports icebound for four or five months in the year.

These advantages result from the following general conditions:

(1) The British Isles lie in the temperate belt and so have a temperate insular climate.

(2) They lie in the great belt of the Prevalent Westerlies, which bring warmth and moisture from the warm North Atlantic.

(3) Towards the British Isles drifts the warm North Atlantic Drift, pushed on by the Westerlies and bringing its warmth and moisture.

The Westerlies.—The reason for the prevailing Westerlies (a term which includes any wind with a westerly factor in it) will be understood from an examination of the following facts:

(1) In the neighbourhood of Iceland is a more or less permanent region of *low pressure*, which is most pronounced in winter.

(2) In the neighbourhood of the Azores is a more or less permanent area of *high pressure*, which is most developed in summer.

(3) In winter the effect of the "Icelandic Low" is to cause strong south-west winds over the British Isles. (Circulation of air round low-pressure areas in the northern hemisphere is counter-clockwise.)

(4) In summer the effect of the "Azorean High" is to cause south-west and west winds over the British Isles. (Circulation round high-pressure areas in northern hemisphere is clockwise.)

The Westerlies we experience, then, are mainly the effects of the relative position and intensity of these two important pressure distributions.

Cyclones and Anticyclones.—Our climate is considerably modified by the passage of local pressure systems across our

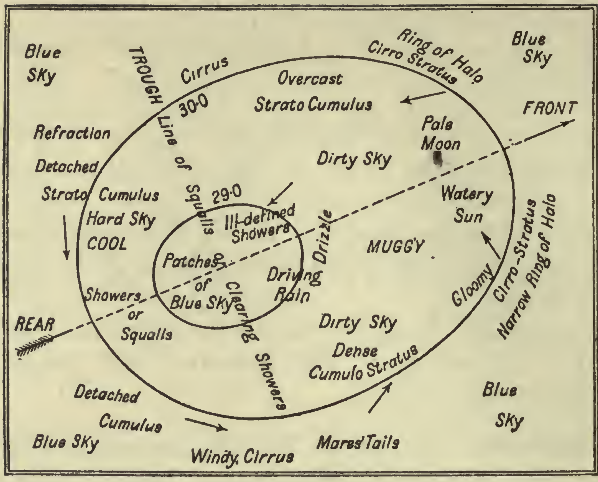

FIG. 15.—WEATHER AND WIND DIRECTION IN A NORTHERN CYCLONE

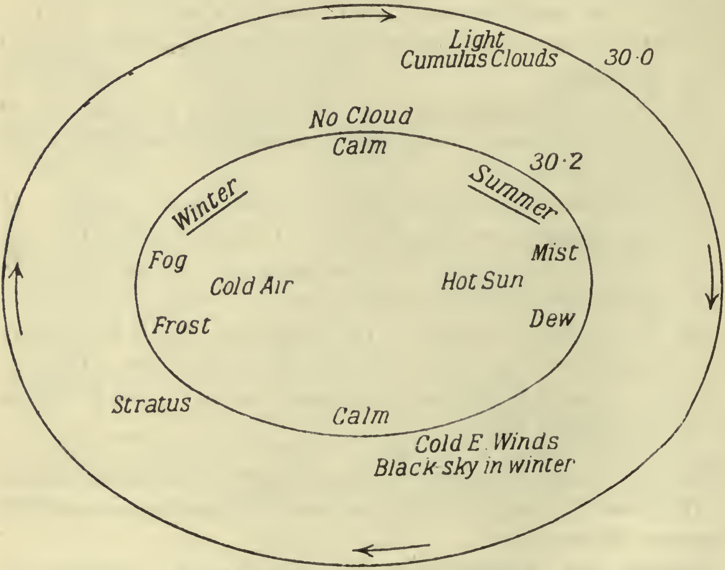

FIG. 16.—WEATHER IN ANTICYCLONE
(After Abercromby)

islands. These are eddies in the great stream of the Westerlies, and are the chief cause of the changeable weather for which the British Isles are notorious.

Cyclonic depressions are low-pressure systems in which air is whirling spirally inwards and upwards in a counter clockwise

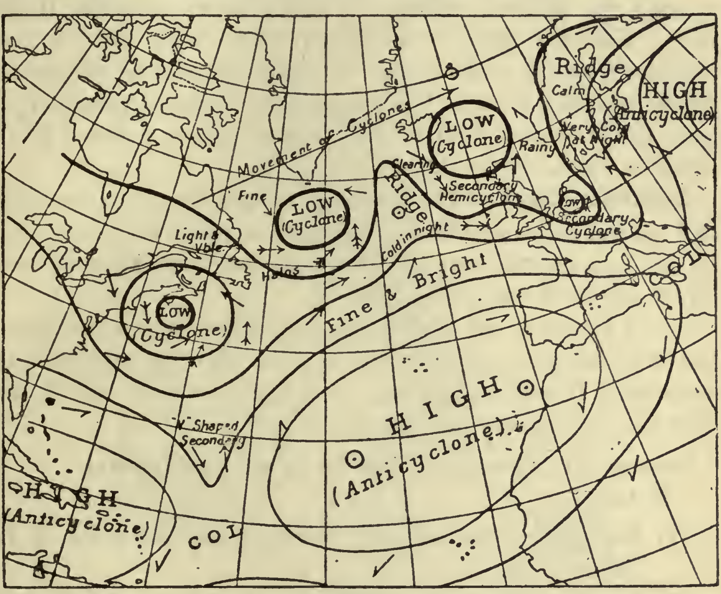

FIG. 17.—PROCESSION OF CYCLONES

direction, and so condensing much of its invisible moisture. Cyclonic depressions bring dull, wet weather. They are most frequent in *winter*.

Anticyclones are high-pressure systems in which air is slowly whirling downwards and outwards in a clockwise direction. They bring fine dry weather, and usually persist longer than the average cyclone. They occur both in *winter* and in *summer*.

The diagrams show the characteristic weather and the arrangement of the isobars in cyclones and anticyclones respectively.

Trace these on transparent paper. Move each slowly eastwards across the map over your town and notice carefully the changes in the weather as they pass.

Weather reports sent to the Meteorological Office by its trained observers all over the country enable the "clerk of the weather" to map the system—cyclone or anticyclone—over the British Isles. Cyclones follow well-defined tracks from west to east, and their future position can be fairly accurately determined for the next day or two. Forecasting the weather depends largely upon the ability to foresee the probable future position of the pressure system of the day.

Isothermal Charts.—The average conditions of temperature and rainfall which decide the climate of a region, are summarised for us in a general way in the Isothermal and Rainfall maps which appear in any good atlas.

It will be worth our while to examine carefully the Isothermal and Rainfall maps for the British Isles. Let us take first the Isothermal Charts for January (the typical winter month, and July (the typical summer month) respectively.

Look at the Isothermal Chart for an average **January.**

Notice:

(1) The general north–south trend of the isotherms of the western half.

(2) The closed isotherms, registering the lowest temperatures, in the eastern half.

(3) The general decrease of temperature from south-west to north-east.

(4) The significant northward bend of the isotherms over the water belt between Ireland and Britain.

These features suggest the following conclusions:

(1) That west of the British Isles in January lies a warm influence; east of them a cold influence. The former is warm air over the East Atlantic, which is wafted inland by the Prevalent Westerlies; the latter is the continental

landmass which soon parts with its summer warmth and shows the effects of short days and a lower sun.

(2) The eastern and south-eastern portions of our islands which

FIG. 18.—JANUARY ISOTHERMS

lie nearest the Continent are much more affected by continental than by oceanic conditions.

(3) This shows the effects (*a*) of latitude, and (*b*) of the general north-west drift of warm water from the Atlantic.

(4) Shows more clearly the presence of warm water between the two main islands.

Consider now the **July** *map.*

Notice—

(1) The general west-east trend of the isotherms.

(2) The closed isotherms in the south-east registering the highest temperatures in the islands.

FIG. 19.—JULY ISOTHERMS

(3) The general increase of temperature from north-west to south-east.

(4) The significant southward bends of the isotherms over the North Channel, the Irish Sea, and St. George's Channel.

From these features we infer :

(1) That the colder influence is to the north in summer, instead of to the east as in winter; and that the warmer influence lies to the south instead of to the west as in winter. This is what we should expect from a consideration of latitude.

(2) In summer the continental land mass quickly responds to the effects of longer days and a higher sun. That part of the British Isles nearest the Continent tends to reflect continental conditions.

(3) This shows the effects of latitude, together with those of the presence of a relatively cooler influence—the Atlantic—to the westward.

(4) This suggests the effects of relatively cooler water belt between the two main islands.

Thus the January isotherms run practically at right angles to those of July. Follow these isotherms across Europe. Notice that the *January isotherms of* 40° F. passes from the Shetlands along the west coast of Britain, and almost due south to the latitude of Bordeaux; thence by an eastward, and occasional south-eastward trend to the latitude of Salonika and Baku. This means that *it is on the average as warm in January in the Shetlands as it is in Lyons, or Salonika, or Baku.* Yet Baku is 20° farther south. Compare places in the same latitude as the Shetlands, and notice how temperature decreases as one goes east.

The *July isotherm of* 60° F. passes through South-west Ireland and Berwick, thence in a great northward-southward S-curve over Scandinavia, and north-east to the White Sea. This means that *Archangel is warmer in July on the average, than Cork ;* yet the latter is 13° farther north. Compare the July temperatures of places on the Continent with those of places in the same latitude in the British Isles. Notice that temperature increases as one goes east.

All this tends to show the climatic advantages enjoyed by the British Isles, due to their insular situation off the western shore of the European continent, and in the track of the Prevalent Westerlies, which bring warmth in winter and cool air in summer from the North Atlantic Drift.

Study carefully the statistics given in the following table, after locating the places on your map. Note how they bear out the general conclusions stated above.

Station	Mean Temperature (F.°) [Based on Meteorological Office Records].												
	Altitude (ft.)	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sept	Oct.	Nov	Dec.	Year.†
Sumburgh Hd. (Shetlands)	126	39	38	38	41	45	49	53	53	50	46	42	40	
Fort William	31	39	39	40	45	50	55	57	57	53	47	44	40	
Aberdeen	46	38	38	40	44	48	54	57	56	53	47	42	38	
Glasgow	180	38	39	40	45	50	55	57	57	53	47	42	39	
Londonderry	67	40	41	42	46	51	57	58	58	55	48	44	41	
Seathwaite	422	38	38	39	45	50	56	58	57	54	47	43	39	
N. Shields	99	39	39	40	44	48	54	58	58	54	48	43	39	
Valencia	30	45	45	45	48	52	57	58	59	56	51	48	46	
Dublin	47	42	42	43	47	52	58	60	59	56	49	45	42	
Rugby	379	37	38	41	45	51	57	60	59	55	47	43	38	
Yarmouth	10	37	38	40	44	50	56	58	60	57	49	44	39	
Falmouth	170	43	44	44	48	52	57	60	60	57	52	48	45	
Ventnor	80	41	42	44	48	53	59	61	62	59	53	48	43	
London (Greenwich)	155	38	39	42	47	53	60	63	62	57	50	43	40	

† The student should calculate and insert yearly means.

Mean Annual Rainfall Chart.—Examination of this map discloses the following facts:

(1) The western side of the British Isles is much wetter than the east.

(2) Remarkable coincidence with the orographical map; regions of heavy rainfall coinciding with regions of greatest altitude.

(3) The wettest regions are the Western Highlands of Scotland, the Lake District, South and Mid-Wales, and the south-west of Ireland and England. The driest areas lie (*a*) around the Wash; (*b*) around the Thames mouth.

FIG. 20.—THE AVERAGE ANNUAL RAINFALL OF THE BRITISH ISLES
(After H. R. Mill)

Most of these features may be explained by consideration of the following:

(1) The Prevalent Westerlies, bringing moisture from the North Atlantic, are intercepted transversely by the mountainous western regions of the British Isles. They are deflected upwards, and the consequent rapid expansion and cooling results in heavy condensation.

(2) On the eastern side, the Westerlies become descending winds, which contract and become warmer by compression in their descent. Their capacity for holding moisture is increased rather than decreased, and relatively low rainfall results. Eastern Britain is thus the rain-shadow region of the British Isles. (See *World Studies*, pp. 231-34 on the causes of rainfall.)

The following table shows interesting comparisons and contrasts which illustrate the foregoing statements.

STATION.	MEAN MONTHLY RAINFALL. (Inches.) [Based on Meteorological Office Records: *Symons*.]												
	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year.†
Pomona	3.5	3.3	2.8	2.2	1.7	1.9	2.5	2.8	3.7	4.4	4.6	4.4	
Portree	10.3	7.4	5.8	4.3	3.8	4.8	5.1	5.5	7.5	9.2	8.3	9.9	
Inverness	2.3	1.5	1.6	1.5	1.6	1.9	2.7	2.8	2.8	2.4	2.5	2.1	
Glasgow	4.8	3.8	2.6	2.4	2.2	3.1	3.5	4.0	4.3	4.3	3.6	4.5	
Edinburgh	2.5	2.2	1.6	2.0	1.9	2.1	2.8	3.1	2.9	2.2	2.5	2.4	
Omagh	3.7	2.4	2.3	2.2	2.2	2.7	3.3	3.5	3.7	3.9	3.3	3.5	
Belfast	3.3	2.7	2.1	2.0	2.2	2.2	3.0	3.1	3.3	3.8	3.0	3.1	
Seathwaite	17.6	14.1	10.5	6.8	6.5	7.2	8.8	10.6	13.7	14.7	13.3	15.8	
Seaham	1.8	1.6	1.7	2.0	2.0	1.9	2.8	2.7	2.8	2.6	3.1	3.1	
Cork	5.1	3.9	2.9	2.8	2.4	2.9	2.4	3.2	3.7	3.8	3.9	4.3	
London	2.5	1.8	1.6	1.9	1.9	2.5	2.4	2.4	2.7	2.7	2.1	2.5	
Birmingham	2.8	2.3	2.1	2.2	2.5	2.7	3.0	3.2	3.6	3.4	2.4	2.7	
Lowestoft	1.8	1.8	1.7	1.7	1.8	1.6	2.7	2.2	2.7	2.1	3.0	2.6	
Penzance	5.8	4.1	3.0	2.8	2.1	2.0	2.7	3.2	3.8	5.1	4.9	5.4	

† The student should calculate and insert yearly means.

Climatic Regions.—The British Isles may be divided into four main climatic regions. These are roughly delimited by the January isotherm of 40° F. and the July isotherm of 60° F. which run approximately at right angles. Fig. 21 summarises the average temperature conditions of these regions.

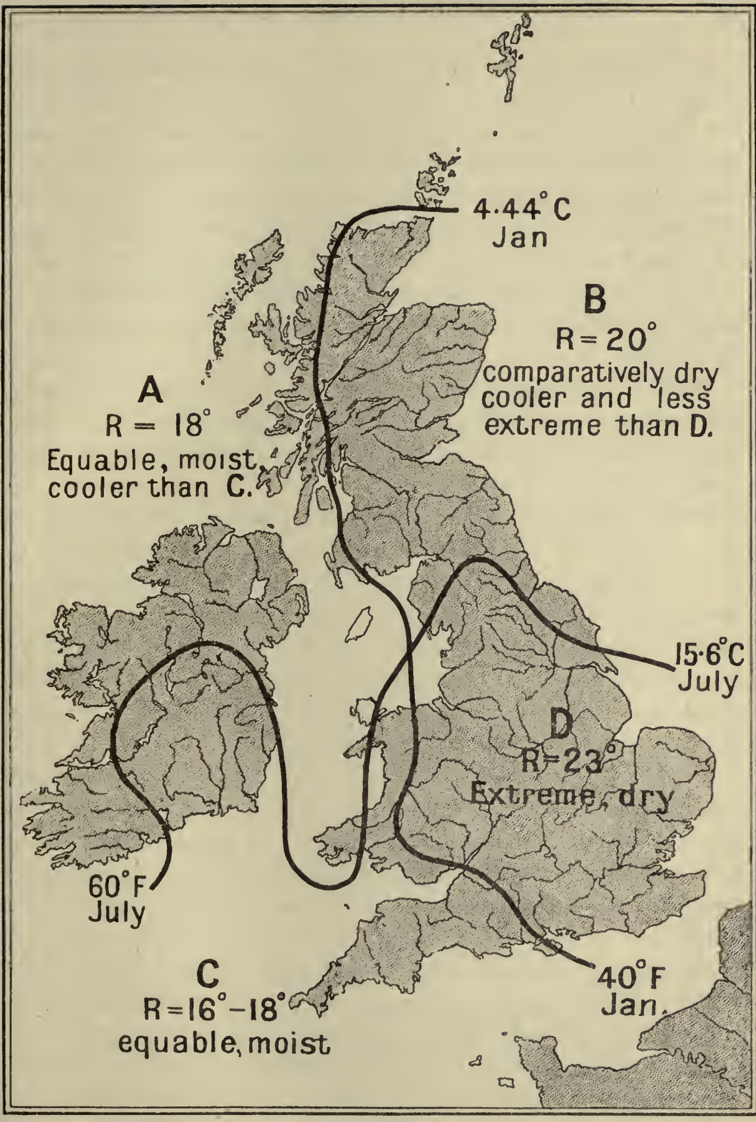

FIG. 21.—CLIMATIC REGIONS OF THE BRITISH ISLES
(N.B.—The expression " extreme " is a purely relative one. It does not imply " extreme " in the continental sense.)

Of the four regions, D, the south-eastern one, has the greatest range of temperature. It is least equable; lying as it does near the Continent, it partakes of continental conditions to a greater extent than any other region. Although Scotland is farther north than England, it has, on the whole, a more insular climate; on the east it faces the widest part of the North Sea. The south-western region, C, has the least range, and therefore the most equable climate. It lies on the shore of a warm ocean in the track of the Westerlies, and is pronouncedly insular in climate.

Western counties are generally the wetter and more equable; eastern counties the driest and more extreme. Eastern Ireland, around Dublin, has a greater range than Western Ireland in the same latitude.

Climate, Plant and Animal Life.—The British climate favours the cultivation of the important food plants dealt with in Chap. IV, and the growth of rich pastures upon which fine breeds of sheep, cattle, horses and pigs can be reared. The richest arable lands are in the lowland regions where rainfall is sufficient but not too great. The map (p. 42) shows where Britain's richest arable lands lies. Compare this map with (1) the relief map and (2) the mean annual rainfall map of the British Isles.

Wheat is grown chiefly in the south-east of Britain, where summers are longest, driest and sunniest and where ancient glaciers left in past ages a rich deposit of boulder clay to help to form ideal wheat-lands. Fig. 26 shows our chief wheat-lands; note that the bulk of them lie south-east of a line joining Tees-mouth and Severn-mouth.

Oats stand cold and wet better than wheat, and so does *barley*. These cereals are much more widely spread, and are cultivated even in Northern Scotland and in wetter Ireland.

Root-crops flourish on the moister arable lands, where enormous quantities of potatoes, turnips, swedes, etc., are raised annually.

The best pasture-lands for *sheep* are on the hill slopes of the Southern uplands, Wales, and the oolite and chalk hills of south-east England. Sheep do better than cattle in these regions because they can do with less water. In very damp lowlands sheep are liable to disease.

Cattle flourish best on the rich lowland pastures of Ireland, western Mid-England, and Devon. Since *pigs* thrive upon the waste of dairy farms, they are reared in greatest numbers in the cattle-rearing areas.

Further details of British stock-raising are given in Chap. V.

Climate and Industry.—The general suitability of the British climate for sustained and successful industry has already been pointed out. Climatic conditions govern the *distribution of industries* in that they decide where certain crops can or cannot be grown, and where certain animals can or cannot be reared. At the same time, however, we must remember that conditions of soil play a very important part in deciding whether a region is to be agricultural, or pastoral, or neither.

A striking illustration of the climatic control of manufacturing industries is found in the cotton industry of Britain. A moist climate is essential for cotton spinning; in a dry climate the threads break easily and spinning is rendered difficult and expensive. Thus our cotton industries are mainly located on the moister side of the Pennines, and on the wetter side of the Scottish Midland Plain.

QUESTIONS AND EXERCISES

1. Contrast the climate of the British Isles with that of (*a*) regions in the same latitude in Eastern America; (*b*) regions in the same latitude in Eastern Europe. Account for the differences.

2. Copy the barometric chart on p. 141, and print in appropriate places the probable weather conditions.

3. Draw temperature curves showing mean monthly temperatures for the year, for a place in South-west Ireland, a place in the English Midlands, and a place on the East Coast. Account for differences.

4. What is the value of the Daily Weather Report? Explain simply how it is obtained.

5. Explain the terms "winter gulf of warmth," "Icelandic Low," "reduced to sea-level," "G.M.T.," and "isohyets."

CHAPTER IV

VEGETATION IN THE BRITISH ISLES

A TEMPERATE and equable climate permits a great variety of plant life. Care in selecting and cultivating the best has developed an exceedingly rich and valuable flora well suited to the British Isles. British seed is now much used in colonial and foreign agriculture and British birds and animals are in great demand for breeding purposes and for founding or improving flocks and herds throughout the world.

This care has been exercised since 1750 and especially during the past century. The *Board of Agriculture*, a government department founded in 1793, has been of great service to farmers in collecting and distributing statistics and information. The *Royal Agricultural Society*, established in 1838, has encouraged every county and every agricultural town to form its society for the improvement of agriculture. The annual shows (Royal, County, Town and Village) of agricultural products have stimulated all branches of agriculture and have educated farmers by exhibiting both the products and the means of successful cultivation of plants and animals.

The *Royal Horticultural Society* since 1804 has done much the same for garden culture. Native species have been brought to greater perfection, and new species when introduced have been rapidly made known and adopted in suitable districts. The study of botany, the establishment of botanical gardens, the greatest of which is Kew Gardens, London, and the cultivation of home gardens and allotments even in towns have done much to increase interest in flowers and plants, and to improve the life conditions of the people as well as the attractiveness of their surroundings.

All life—man and animal—depends on plant life; all civilisation and culture rest on agriculture or field-work. Plants alone can prepare the substances in the earth and air for animal use. Agriculture is one of the oldest and most honoured occupations, and plant products have always been most important articles of commerce.

Plants have *habits and associations*, *i.e.*, they grow best in certain soils and climates, and those which have similar needs are often associated, *i.e.*, often grow together. Some trees, *e.g.* beech or pine, grow so closely together in woods and forests and have such dense foliage that nothing (unless early spring flowers) can grow under them. Such trees, in their struggle for light and air, grow tall and straight and develop few strong branches. Their trunks make long, straight timber. Their roots (*e.g.* the beech) are near the surface, they starve other vegetation. When the trees are more scattered and have deeper roots and more open foliage (*e.g.* the oak) smaller plants grow under them. In English hedges, oak, ash and elm trees; hawthorns, wild roses, honeysuckle and blackberry bushes; foxgloves and other flowers and grasses, and perhaps mosses, are found growing one below the other. This is the oak association. They form *storeys of vegetation*.

Similarly on fruit farms we sometimes find tall fruit trees, *e.g.* pears, apples, plums, well separated; fruit bushes, *e.g.* gooseberries, currants, or dwarf pears and apples or raspberry canes; and between them strawberries or cabbages, potatoes or roots if the soil is rich enough.

Both soil and climate depend much on altitude. **On mountains and hills** (chalk, limestone, gravel, sand or clay) the "*top-soil*" is thin, six to twelve inches. The *temperature* is lower than in the plains and the winds are stronger. The water supply is shortened by the rapid escape of the rain, and the fine top-soil is carried to the valleys and plains. Hence often little, except short wiry grass and some very hardy and small wild plants, grows on mountains. Sheep thrive there; pines, firs, larch and spruce trees, which like much light and air, associate on such poor soil, *e.g.* on the Downs or on the higher slopes of mountains. Beeches are often found on chalk, *e.g.* on the Chilterns and on the south side of the South Downs. Yew and box trees (more rare) like chalk uplands (*e.g.* Box Hill, North Downs), and the birch, hardy and graceful, will grow on almost any soil up to

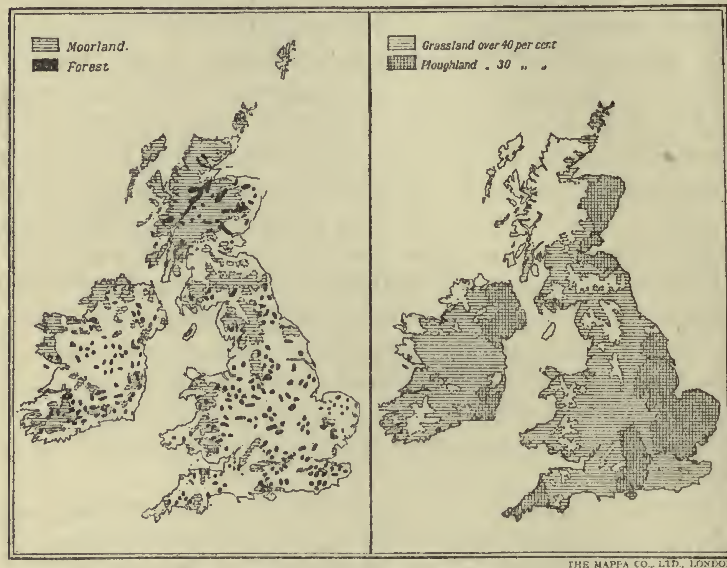

FIG. 22.—FORESTS AND MOORLANDS

FIG. 23.—GRASSLANDS AND PLOUGHLANDS

2500 feet in the British Isles. Mountain forests are very valuable for their timber and for their tempering influence. They are cool by day and warm at night; they prevent the rapid escape of water after heavy rains, preserving the valley from floods, and keep the soil on the mountain sides. They stop rapid evaporation.

The more level but often high **heaths and commons** have a poor soil. They produce pines and firs, also willows where water abounds. Gorse or furze, broom, fern, bracken, heather, rough grasses, rushes, mosses and lichens are found there too. On the **lower slope** the top-soil is deeper and many broad-leaved trees, often woods and forests, are found. Barley and oats and, on southern slopes, wheat, grow there and a richer grass well suited to cattle. In the moister climate of western Britain and of Ireland there are vast grazing areas on the foot-hills and mountain slopes and in the plains. Nearly one-quarter of the surface of Ireland is covered with grass of the rougher and poorer sort, while nearly one-half consists of richer grazing land or "permanent pastures." (*Cf.* map, p. 42.)

But most plants and trees like a rich, loamy soil, as in a fertile **river valley,** with plenty of air, light, water and warmth. Hence valleys and plains in temperate climates are usually fertile and covered with luxuriant vegetation. Except conifers, most trees —oak, ash, elm, lime, birch, poplar, etc., and fruit trees—flourish in sunny and moist areas; most cereals — wheat (drier and sunnier), oats, and barley (moister and colder)—and tall, juicy grasses, roots (carrots, turnips, mangolds, etc.) and potatoes, fruits, flowers, and market products are found in such districts. Here we find the oak-forest association also.

Many valleys are famous for their fertility and beauty. Kent, "The Garden of England," produces much fruit. The Fens have a rich, easily worked, moist soil and produce very heavy crops of cereals, roots, potatoes and fruit. The Thames valley and the Vale of York are very fertile. Cheshire, Herefordshire, Dorset, Devon and Surrey have many dairy farms on their fine grass lands. The Severn valley has great orchards, dairy farms and woods (Dean Forest). The Scottish Rift Valley is very fertile. Lanark grows 3000 acres of soft fruit. In Ireland one-third of the counties of Down and Armagh is under corn, and Armagh has nearly 6000 acres of fruit trees, bushes, and plants. (*Cf.* map, pp. 42 and 86.)

Wild Plants are found in great variety in the British Isles. They have supplied the national emblems. They add to the beauty of the country-side and help to build those pleasant memories which bind an Englishman to his home. In the Early and Middle Ages they were more important than now, as foods and medicines for man and beast. Most of the grazing then was on wild grass; in winter, shrubs and evergreens helped to keep starving cattle alive. The grasses to-day are numerous, nutritious and beautiful. They have been as carefully improved as corn and are carefully cultivated.

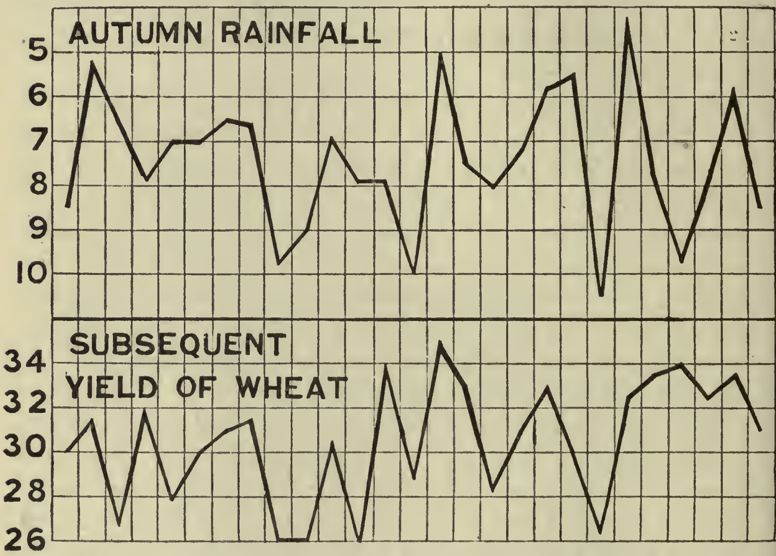

FIG. 24.—GRAPHS SHOWING THE RELATION BETWEEN AUTUMN RAINFALL (GIVEN IN INCHES) AND THE SUBSEQUENT WHEAT HARVEST (BUSHELS PER ACRE)

Brilliant flowering shrubs, like gorse and broom and in some districts rhododendra, give beauty and character to commons and open areas in south and east. Heather grows in profusion on the northern and western moorlands. The wild flowers and plants familiar to Shakespeare still abound especially in the Midlands and South. The south-coast counties from Hampshire to Cornwall are noted for their profusion of wild spring flowers.

Of **cultivated plants**, the *cereals*, as food for man and beast, stand first in importance. Wheat has always been an important crop. The Romans made Britain their "northern granary." The Saxons grew wheat and rye for bread, and barley for beer. *Wheat* requires a hot summer to ripen; its long roots save it from drought. The diagram shows that dry autumns are favourable to a good wheat crop in the next harvest. Wheat is grown chiefly east of a line from Flamborough Head to Hartland Point.

Barley has short roots and requires less sun. It is used to make malt and to feed pigs and fowls. It grows well in the north and in many parts of Scotland and Ireland. *Oats* are hardiest of all. They grow well even on damp, peaty and cold soil. They are very nutritious (oatmeal) and contain much fat-forming food. Hence they became the national food of Scotland and are the chief cereal grown in the British Isles. They are the best food for horses. (See map, p. 86.)

Grass is akin to the cereals and likes similar soils. On hilly, chalky soils sheep find a short, sweet, dry grass which suits them admirably. River valleys and the damp west grow a rich grass for cattle. (*Cf.* Cheshire cheese, and Hereford cattle.) Many pastures are centuries old. Wales is largely devoted to cattle and sheep farming.

The Saxons grew no *roots* and few *vegetables* beside cabbages. Grass was poor and thin through lack of cultivation and manure. There was little food for cattle, sheep and pigs in the winter. Hence these were killed and salted. Salt meat was eaten most of the year and caused many diseases and plagues. The Normans grew rye, which the peasants made into bread, and oats, peas and beans for cattle. The crops were very poor: an acre yielded about eight bushels of wheat, ten or twelve of oats. To-day's yield is four or five times as much.

The discovery of America gave Europe many new and valuable plants. Raleigh brought to Ireland potatoes (1565), *tobacco* (its cultivation is still experimental in Ireland and England). *Maize* and *tomatoes* followed. Maize does not ripen in England, but is fed green to cattle.

Potatoes have become one of the main food crops, especially in Ireland which produces as many as Great Britain. They are very generally grown, but flourish best in and near the Fens, near the Firths of Forth and Tay, and in Ulster. They are liable to disease in wet seasons. Change of soil and climate benefits the growth of potatoes: Scotch seed potatoes are much used in the Fens. Early varieties are grown in the Channel Islands, in Devon and Cornwall, on the terraced cliffs of Dorset, in Kent, etc. Continuous supplies of new potatoes (*e.g.* from the Canary Islands) are sent to London and other large towns from January onwards. Starch and also a crude spirit are made from potatoes. (*Cf.* map, p. 86.)

Roots have revolutionised stock raising and our meat supply. They, with many other improvements in farming, came to us in the seventeenth and eighteenth centuries, from Flanders and Holland. Mangolds, turnips, carrots and parsnips grow well on moist soils. They are very juicy, and in the Fens grow to a great size. Turnips and swedes are hardy, and grow in all parts of the British Isles. Roots provide ample and valuable food for all kinds of farm animals, and thus enable them to be fed and fattened through the winter instead of being killed and salted in the autumn. Hence wholesome fresh meat has become a common and cheap food in winter, and disease has been much diminished. Roots contain valuable food and salts for man and beast. The winter milk supply depends largely upon them. The large numbers of cattle fed on roots make much valuable manure, while the roots themselves in growing prepare the soil for corn crops. Land need not now lie idle or fallow: it can be well cleaned while the roots are growing, and it receives ample manure from the cattle that eat them. With the green fodders, roots make possible a four, five or six course rotation without idle land. (*Cf.* Chap. VII.)

The sugar beet was grown before the war in Norfolk, Suffolk and Cambs, and a factory was established at Cantley, in Norfolk, by the Anglo-Dutch Corporation. Since the war the Ministry of

Agriculture has supported an experiment in Notts. In 1921 some 420 farmers were growing sugar beet on nearly 2400 acres, and a factory was set up at Kelham (near Newark) under French direction. After the sweet juice is pressed out the beet makes good food for milch cows.

The Flemish brought us *hops*, celery and various species of cabbages. Hops spread and became an important crop in the south-east (Kent and Sussex) and west of England (Hereford). Celery is an important Fen crop. *Green fodders* or cattle foods are another very valuable gift from the Dutch. Vetches, clover, lucerne, sainfoin, are of the same species as peas and beans; they form excellent food for cattle, both green and as hay. Clover is the best and most common of these; like the others it can be mown several times in a season and will flourish for several years on a good soil, which it prepares—rests and feeds—for wheat growing. Sainfoin grows well on poor, chalky soils and yields well for eight or ten years. Lucerne has deep roots, but likes rich soil. It is excellent for butter producing and may be cut every six or eight weeks. Green fodders of the cabbage species, rape, kohlrabi and mustard, are grown for feeding sheep in autumn. They are quick or "catch" crops which grow rapidly after another crop has been harvested.

Peas and beans are flesh-forming foods and grow well in the clays and firm loams of the East and Midlands of England. Ireland grows very few. They require lime and a damp climate with a drained soil. Land soon becomes "bean sick," *i.e.* exhausted for beans and peas. Farmers in the Midlands and Fens, having a good soil, send large quantities of table beans and peas to the large towns.

Flax, once an important cultivated crop, is now little grown and chiefly in Ireland. It was grown under the Romans, and before cotton was brought from America, it was the chief vegetable fibre. Since the sixteenth century it has been grown less and less, in spite of bounties. Machine-spun cotton, being finer than hand-spun, considerably lessened the demand for linen.

Although linen manufacture is still an important British industry, most of the flax is imported, *e.g.* from Russia, Holland and Belgium. Flax was believed to exhaust the land and the fibre is troublesome to prepare for the market. The names Flaxton (Yorks), Little Steeping (Lincoln), Retford (Notts), Flax Bourton (Somerset), mark some former flax-growing districts. Attempts were made to revive it in Suffolk, 1870–80, with little success. In 1910–11 flax was grown at Ely for its seed, which yields linseed oil and is afterwards pressed into cakes for cattle food. In 1912 Great Britain had about 850 acres and Ireland 55,000 acres under flax. A moist, rich soil suits it. The war revived its cultivation in Lincolnshire, Essex, Dorset and Somerset.

Vegetables and Flowers.—The growth of great towns and manufacturing areas has caused a great decrease in private vegetable gardening, but the war made allotments popular. Around London and some other great towns are belts of "market gardens" from which vegetables and flowers are sent overnight by road to the early morning markets (*e.g.* Covent Garden), whence they are distributed by greengrocers. Potatoes, turnips, carrots, onions and cabbages, flowers and fruit, are also grown on more distant farms and sent up by train.

Near Reading, at St. Albans and south of London, are large gardens where horticulturists grow *flowers*, bulbs and seeds for gardeners and the market. The warmer climate of the Channel and Scilly Islands permits them to supply early flowers, fruit and vegetables to London markets. The Scilly Isles export tons of early flowers, especially daffodils, to London. South Cornwall sends narcissus. Flower growing for the large towns is an important industry. North Cambridgeshire and Lincolnshire are developing it. The Channel Isles exported to us in 1913, potatoes, nearly £620,000, tomatoes, over £400,000, and fresh flowers, over £130,000. Flowers and vegetables come a little later, from the southern counties also.

Fruit Trees have been much improved during the past century, especially in the south and east of Britain as far north as the Wash. Apples and pears grow to great perfection in size, soundness and flavour. Varieties suitable for all soils and situations, ripening early or late, for eating or cooking, for immediate use or keeping, may now be grown. The development of jam making and the need for fruit in large towns, has increased the importance and variety of plums. Luscious strawberries ripen in the south-eastern counties, the Scotch lowlands and in Armagh, raspberries and currants in almost any fruit garden. The grape, formerly grown in the open by the monks, now ripens only under glass.

Fruit growing is a form of agriculture which has rapidly developed of late years. It requires a rich soil and a mild spring. Late frosts cause much damage to fruit blossoms. The Fen skirtlands, Kent (strawberries and cherries), Devon, Worcester and Hereford produce vast quantities of fruit for the great towns. In the soft-fruit season special fruit trains are run every night to London, Manchester, Leeds, and other large towns, from fruit-producing districts. Well-known jam factories have been built in the heart of fruit-growing districts. In the west of England cider is made from special species of apples.

British Nuts are not so successful. Kent cobs and walnuts are the best. Walnut trees are scattered throughout England. Chestnuts grow in Norfolk. These are not so large and sound as foreign nuts, but it is claimed that their flavour is better. Hazel nuts are small and little used. Acorns and beech nuts, once valuable food for pigs, are now neglected. Our chief nut supply is imported.

TABLE I

The Use made of the Land in the British Isles in 1912

The numbers given are thousands of acres—*e.g.*, England's total surface is 32,564,000 acres.

	Total Surface *	Woods.	Mountain and Heath Grazing Land.	Permanent Pasture.	Arable Land.	Arable Land Roughly in Millions of Acres.
England .	32,564	1,720	2,436	13,818	10,597	11
Scotland .	19,662	875	8,920	1,496	3,325	$3\frac{1}{2}$
Ireland .	20,371	302	2,700	9,685	4,988	5
Wales .	4,772	187	1,339	2,022	738	$\frac{3}{4}$
Isle of Man .	141	1	33	17	76	$\frac{1}{13}$
Channel Isles	44	.17	2	9	22	$\frac{1}{50}$
Totals .	77,554	3,085.17	15,430	27,047	19,746	20

* This includes land under water.

EXERCISES

1. Calculate (*a*) the percentage of total surface occupied by mountain and heath in Scotland and Wales, of permanent pasture in England, Ireland and Wales, and of the arable land in each division; (*b*) all totals as percentages of total surface.

2. Compare the total arable land of the British Isles with the total surface of England and Wales, Scotland and Ireland.

3. What uses are made of permanent pasture? Give a list of products obtained from it.

4. Why is the arable land chiefly on the east and the moorland on the west of the British Isles? (*Cf.* map p. 42.) What can be done to cultivate mountain and heath grazing land?

5. Why is nearly a half of Scotland mountain and heath grazing land and nearly half of England and Ireland permanent pasture? Show by a sketch map the distributions of the two kinds of grass lands.

6. Draw diagrams to represent (*a*) the area of arable land, (*b*) the percentage of arable land in each of the first four divisions.

TABLE II

THE CHIEF REGIONS FOR GROWING CORN, ROOTS AND HAY

Crops.	England and Wales.	Scotland.	Ireland.
Wheat .	S.E. of York-Bristol line	East to Aberdeen	(1) Leinster (2) Munster
Barley .	E. Anglia, Midlands, N.E.	East to Aberdeen	(1) Leinster, $\frac{3}{4}$ (2) Munster, $\frac{1}{4}$
Oats .	N., E., S.E. and S.W.	All, especially Fife to Banff	Ulster (nearly $\frac{1}{2}$)
Peas and Beans	Midlands and East	Perth, Stirling, Ayr	
Potatoes	E., E. Midlands and N.W.	Forth and Tay basins, Ayr	Ulster (nearly $\frac{1}{2}$)
Roots* .	E., E. Midlands and N.W.	East to Banff	Leinster and Munster†
Hay .	N. and W., least in the E.	S. and E.	Munster

* Turnips and swedes are hardy and are well distributed. Mangolds are grown north of York and Dundalk.

† Ulster grows its share of turnips and swedes, but very few mangolds.

QUESTIONS

1. Which districts in England, Scotland, and Ireland are the most productive? Make a table showing the chief products of each, adding the fruit crops from Table III.

2. Which Irish province produces the most human food? (*Cf.* Table I., Agriculture.)

3. Explain how the national health and well-being have been improved by the introduction of root crops.

TABLE III

THE DISTRIBUTION OF SPECIAL PRODUCTS

Apples and Pears	Western Counties, Cornwall to Worcester, Kent, Cambs, Lanark, Perth, Armagh, Antrim.
Soft Fruit	Kent, Hants, Cambs, Essex, Perth, Lanark, Denbigh, Antrim, Armagh, Cork.
Cherries	Kent grows more than half the crop.
Plums	Kent, Cambs, Evesham, Lanark, Perth.
Early Vegetables, Potatoes and Flowers	Channel Isles, Scilly Isles, Cornwall, Dorset.
Celery	South Lincs and the Fens.
Mustard	East Anglia (Colman's factory is at Norwich), Cambs, Leicester, Lincs, Norfolk.
Hops	Kent grows three-fifths, Hereford, Sussex, Worcester, Surrey.
Flax	Ulster, Dorset, Somerset, Suffolk, Lincs, Yorks, Fife, Perth.

In 1912 there were in England and Wales 78,000 acres of small (soft) fruit, and nearly 245,000 acres of top or tree fruit, including 162,000 acres of apples. The acreage of soft fruits was reduced during the war. In 1920 it was 59,000 for soft and 220,000 acres for tree fruit.

EXERCISES

1. In the fruit and hop picking season extra hands are wanted. Many poor town people make this work their holiday. In which districts and months might we expect to find pickers at work from London, Birmingham and Glasgow?

2. For what manufactures are flax, hops, apples, strawberries and plums used, and where are the factories?

CHAPTER V

ANIMAL LIFE IN THE BRITISH ISLES

CLIMATE and soil, and their joint product, vegetation, determine largely the species, size and character of animals. In the British Isles man has brought animal life almost entirely under his control as far as these natural conditions permit. The first step in this mastery is destruction.

Wild Beasts are killed both for food and clothing, and for safety. As man multiplied and became more civilised the land was rapidly cleared of dangerous animals, and others were tamed. The last bears were slain in Scotland in the tenth, reindeer in the twelfth, the wild boar in the seventeenth, and wolves in the eighteenth century. But half-wild cattle of the most ancient stock are still bred in Chillingham Park, Northumberland, and in Cadzow Forest, Lanarkshire. Stags, roebuck, fallow and red deer are kept in many private parks and especially in the large deer forests of the North of Scotland. They are "preserved" to be hunted or stalked at certain seasons.

The Norman kings claimed the forests, *i.e.* "open" or unoccupied land, for themselves. New Forest was much extended and consolidated by William II., who destroyed villages and drove away the people. *Severe forest laws* forbade men to kill deer, wild boars, rabbits, and game of all kinds. The State still protects wild birds and has the sole right to issue licences to kill game. To-day, forests have been much reduced, but Epping and Hainault Forests, near London, and the Dean and Sherwood Forests still remain in England. There are also many preserves where game animals and birds are bred for sport.

The fox is the largest free wild animal in Britain. It and the otter are preserved for hunting. Fox-hunting encourages the breeding of good horses. Hares are coursed in the spring and autumn cornfields: rabbits abound in wooded and sandy districts and are a valuable food supply. Special breeds of dogs are kept for hunting these animals. Squirrels are common in woods and forests, especially where the beech grows. Snakes do not exist in Ireland, and those in Britain are rare, and except the viper in the South are not poisonous.

The **Wild Birds** are comparatively small. Eagles are occasionally seen in Scotland and Ireland; owls and hawks are common. Magpies and jays are found in the woods; jackdaws and crows like the society of man. The rookeries of many country villages are an interesting feature. Wild *water-fowl* have become much rarer during the past century owing to the draining of the fens and other marshes. Wild swans, geese and flocks of ducks sometimes visit us in winter. Herons are still met with in marshy districts.

Game Birds are numerous in Britain, and on many estates are carefully preserved at great expense for game-shooting. The chief are the pheasant, partridge, and in Scotland, grouse. These are protected, *i.e.* "preserved," during the breeding season, otherwise they would long since have been extinct, for killing the parent bird destroys the whole nest of young. Shooting grouse begins on August 12th, partridge on September 1st, pheasants on October 1st. Many other wild birds are shot, duck in some districts and geese much more rarely. Rook and pigeon-shooting is necessary each year for the protection of farmer's crops. Game birds only are preserved, but the law forbids taking the nests and eggs of most wild birds.

Sea-fowl abound on British shores. Their eggs are a valuable source of income to adventurous climbers on the cliffs and islands of Scotland and Ireland. Some sea birds are taken for their plumage, few are eaten.

British *Song-birds* are particularly numerous and varied. The best-known are the nightingale, thrush, blackbird, skylark, finch, linnet and robin. Their eggs are protected by law. Many of them are migratory birds, such as the nightingale, cuckoo, swallow, and martin.

Migration is a great feature of wild life. Most of us have noticed the coming of swallows, and watched myriads of these birds gathering for their journey to warmer countries, in the early autumn. We may remember

> Cuckoo in April, Cuckoo in May,
> Cuckoo in June, in July flies away.

But we do not realise that a very large number of our birds, from the wild swan to the willow-wren, come and go with the seasons every year. The water birds (wild geese, ducks, etc.) prefer cold climates and come to us for our mild winter, flying north in the spring. Most land birds come for our summer and return to Africa and Asia for the winter. Many of these birds travel thousands of miles, at a great speed (50 to 200 miles an hour), and often at a great height. Fish too travel great distances in the sea, but wild animals in Britain have but a small range of movement.

Wild birds and beasts often cause damage and loss to farmers and others. Foxes attack hen roosts and sometimes kill game birds, rabbits, and even very young lambs. Rabbits and hares eat off the young crops. Moles injure crops by burrowing. Rats and mice are the most harmful. They multiply very rapidly and infest cornstacks and barns where they destroy great quantities of corn. In the warehouses and stores of towns and seaports they do great damage to all kinds of food-stuffs. They cost the nation millions of pounds per annum, and organised efforts are now made to exterminate them. Game birds, pigeons, and much smaller wild birds, *e.g.* sparrows, damage the ripe corn. Many small wild birds attack ripe fruit, the blackbird and starling especially do great damage, but they and others are also valuable in destroying (eating) vast numbers of insects and grubs which injure the fruit and fruit trees.

All domestic animals have been derived from wild species. The best and most common were tamed and bred long before history was written. British horses and hunting dogs were famous in North Europe, before the Romans came, and cattle were reared in great numbers. The *Romans* improved British cattle and introduced hornless sheep, fallow deer, fowls, geese, pheasants and rabbits.

The *Saxons* knew little about cattle-breeding. They used oxen for farm work, but they were not well-bred. Wool, however, began to be valuable before the Conquest, and under the *Normans* sheep-farming became more and more important. The dearth of labourers caused by the Black Death (1348), and the steady rise in the value of wool, gave a great impetus to **sheep-farming** on all the downs and wolds, and even in the river valleys. Sheep gave very little trouble (except in disease), and supplied meat, milk (the ewes were milked), skins and wool—a light, easily stored and exported, and most valuable product. Hence they were bred with some care and chiefly for their wool, yet the wool was coarse and the fleece was light—2 lbs. as against 10 or 12 lbs. to-day.

Cattle were used chiefly for farm work, and were very small and thin. They supplied great quantities of butter, milk and cheese (made from skim milk) but their meat was poor and lean; the carcase weighed about 400 lbs. (to-day 1200 to 1600 lbs.). Poor food made good breeding difficult. They were rarely fatted except for feasts. Most cattle, sheep and pigs were killed and salted in autumn, owing to lack of winter foods for them.[1] Thus only salted meat and fish were available in winter, and people suffered many diseases in consequence. Mixed horse and cattle teams were common but not very convenient. The ox was steadier than the horse, though slower; its keep, harness and shoes cost less, its steady pull broke less home-made gear.

Great horses were reared on some farms, especially in the South and East, but these were for war and travel. Heavily-

[1] *Cf.* Chap. IV.

armed knights used a heavy horse similar to the heavy farm and draught horses to-day. Smaller horses were used on farms. The horse ate four times as much as the ox, needed more attention, and could not be eaten when too old for work. Hence careful horse-breeding waited till Stuart times, when iron gear and implements, and wheeled implements and vehicles, made the horse's superior strength and speed displace oxen for labour.

Pigs and Poultry, the scavengers of the village, were the poor man's meat, as they still are in many parts of England and Ireland. Everyone kept pigs in summer, fed them in the woods on beechnuts, acorns and roots in the autumn, and salted them for winter food. Poultry and egg *rents* were common. They served to keep the lord supplied and were convenient when money was little used. Geese and fowl were so common that their fat was used for greasing farm implements, but rabbits were scarce and dear. Pigeons were bred in vast numbers by the lord. They damaged everyone's corn-crops, but were a favourite food and their manure was valuable. Turkeys were introduced later from America. **Bees** were kept in great numbers. Honey served for sugar or to make mead, and candles were made of the wax.

Until the *Tudor* period wool was the most valuable animal product. Sheep and pigs alone were bred with care. Farmers thought chiefly of satisfying their own needs, not of trade. The roots and fodders of to-day were unknown. Animals were almost starved in winter, and could not develop well. Corn was too valuable and grass was scarce, therefore most animals, even sheep, were killed and salted in autumn.

With the *Stuarts*, agriculture and stock-breeding began to improve rapidly. **Foreign horses** were now introduced, especially heavy Flemish, and light swift Arabs, Barbs, and Turks. Charles II. founded the breeds of English thorough-breds by importing a stud of Barb mares which were afterwards sold in England. As roads and vehicles improved these fast horses were sought after. Several countries were becoming famous for breeds of cattle. Lincolns were good draught oxen. Yorkshire, Derbyshire, Lancashire and Staffordshire bred good cattle for meat. Welsh and Anglesey and especially Scotch cattle were hardy and suitable for poor pasture. The Dutch cows of Lincolnshire and Kent were best for milking. But size—long legs, and bodies—was still sought after. The famous "Lincolnshire Ox" was 19 hands (76 inches) high and 4 yards from face to rump.

Sheep were still judged chiefly by their wool. Small Herefords gave the finest short wool, Cotswolds gave longer and coarser fleeces, the Midlands bred large sheep with long wool, but the largest were found in Lincolnshire. Small and sweet mutton was and is still bred on the Welsh mountains. In 1696 it was estimated that there were 600,000 horses, 4,500,000 cattle, 11,000,000 sheep and 2,000,000 pigs in England and Wales. (*Cf.* Table I., p. 61.)

Great improvement in animals was made in the eighteenth and nineteenth centuries. Wool was no longer so valuable, for European and Australian supplies lowered prices, but as industries and wages improved, mutton, beef, pork were in growing demand; cattle-breeding became a profitable hobby. The land enclosures and the new root crops made feeding and fattening much easier and cheaper. English farm stock improved rapidly. The average weight of animals sold at Smithfield Market, London, doubled between 1710 and 1795. Oxen rose from 370 lbs. to 800 lbs., calves 50 to 140, sheep 28 to 80, lambs 18 to 50. This added enormously to both the supply and the value of meat. It proves the importance, to animals not less than to man, of suitable food and shelter.

The Royal Agricultural Society, founded 1838, has greatly improved the breed of every domestic animal. Even dogs, cats, rabbits and guinea-pigs have societies and exhibitions which encourage true breeding. Queen Victoria was patron of the society from 1840 to 1901, and many of the reforms in breeding and agriculture were at once carried out on the Royal farms. This example was soon followed. British species have been improved, and foreign breeds have added to their variety and quality. Suitable food, warm, dry shelters, the expert care of stockmen and veterinary skill have raised British domestic animals to the first place in the world's breeds.

Agricultural shows brought together the best animals, ambitious farmers and expert buyers. Thus breeders were educated; stock-raising became a hobby as well as a business. Pure-bred or pedigree animals fetch high prices and have been in great request since 1850. They are exported to colonies and young states in great numbers, to found their well-bred flocks and herds. We in return now receive from them excellent wool, butter and beef.[1]

Many **Industries and Occupations** depend on animal products. Woollen and leather manufactures are the most important, but have now become *town* industries. The North-Midland cattle region, especially Northants, Derbyshire and Staffs, has great leather industries, and boot and harness factories; bones are ground to make manure or calcined to make china (Potteries); horn is used for handles (Sheffield), horse-hair for mattresses, seats and cushions.

Curing bacon (Ireland and Wilts) and hams (Yorks, Cumberland and Westmorland) is an important industry. Butter (Devon, Bucks, Cheshire, Ireland), cheese (Cheshire, Derbyshire, Cheddar, Gloucester, North Lancs, and Yorks), dried milk (Surrey and Cheshire), are still important British products.

Animals, like people, flourish best in surroundings suitable to the different species. Sheep need little moisture and have small mouths; they do well on poor and short grass on hills and mountain slopes. The Downs, Cheviots, Chilterns, North Pennine, Scottish Lowlands, Argyll and Welsh mountains are great sheep areas. The more mountainous the country, the

[1] The Ministry of Agriculture and Fisheries (Whitehall Place, S.W.1) exists to help farmers, stock breeders, dealers, corn merchants and others. It publishes pamphlets, and issues free yearly returns of crops and weekly returns of market supplies and prices of every form of produce and live and dead stock at the principal British markets. Annual reports of the total produce, prices, supplies, acreage and live stock, etc., are published and sold cheaply. These are very valuable for the student and teacher.

smaller the sheep. Welsh mutton is very small and much esteemed.

Some sheep are reared for size and quality of the meat, others for the weight and fineness of wool, some for both.

1. Some *long-wooled* breeds are Leicesters, Lincolns, Cotswolds, Devons, and Roscommons.
2. *Mountain breeds* are very hardy as to climate and food. They are small and horned, and produce excellent mutton. Such are the Black Face breeds (Northern Counties), Scotch Black Face, Cheviots, Welsh Mountain, Exmoor and Dartmoor.
3. The *Down breeds* give excellent meat and fine wool of medium length: South Downs, Shropshires, Dorsets, Rylands (Hereford).

Horses, cattle and pigs flourish in the rich valleys and plains. There are also mountain ponies and cattle—small, active, wiry, sure-footed, half-wild—especially in Wales, North Scotland and West Ireland. Pigs are scavengers, and live on the offal of corn farms and the waste products of dairy farms. Goats are the poor man's horse, cow and sheep. They live on the roadside, waste land, or moors, will draw a load, give nourishing milk and meat. Their skins are useful. Ireland has 440,000 goats.

The **Breeds of British Horses** differ widely according to their purpose. Their names usually show in which districts they are commonly bred.

Some of the best known classes are:

1. *Heavy draught horses.* Shires (England), Suffolks and Clydesdale.
2. *Lighter horses.* For coach work: Cleveland Bays, Yorkshire Bays.
3. *Light horses.* Hackneys: trotting horses of mixed Arab descent, Hunters, Thoroughbreds, or racehorses, of Arab descent.
4. *Mountain and Moorland Ponies.* Shetland (smallest, much used in coal mines), Highland, Galway, Welsh (the best), Exmoor, Dartmoor, New Forest.

Some **British Cattle** are bred chiefly for beef, others for milking, other species are good for both. They differ widely and can be selected to suit climate, district (food supply). Long, juicy grass especially suits milking cows. Cattle are reared largely in the river valleys and on the western hills.

1. Some Shorthorns, Herefords, Aberdeens, Angus, Devons, produce excellent beef.

2. The Ayrshires, Jerseys, and Guernseys and Kerries (Irish) are the best milkers.
3. Some Shorthorns—Red Poll, South Devons, Welsh black—and Longhorns are good for both beef and milk.

British Pigs are bred for pork and bacon. There are not many breeds, but each has its breeding society and stock book. Ireland raises pigs in great numbers, especially Large White Yorkshires weighing up to 10 cwt. Middle White, Berkshires (much exported), Large Black (Devon and Cornwall, Essex and Suffolk), Tamworths, Lincolns, and Large White Ulsters are also important in England. Pigs are reared most on the richest arable lands, Divisions IA. IB., and fewest are found in VA. VB. (*cf.* Fig. 26, p. 86). In Scotland, Fife, Kinross, Midlothian and Wigtown, in Ireland, Antrim, Armagh, Down, Wexford breed many pigs.

TABLE I

British Animals (both young and full-grown) in round numbers, pre-war.

	Thousands of			
	Horses.	Cattle.	Sheep.	Pigs.
England	1,150	5,000	16,500	2,300
Scotland	200	1,250	7,000	150
Ireland	600	5,000	3,800	1,400
Wales	150	750	3,500	250
United Kingdom	2,100	12,000	30,800	4,100
Pre-war value full grown, each	£10–60	£10–18	£1½–3	£1–2
Value fatted, sold by weight	—	to £30	to £6	to £5

1. During the war the number of cattle remained fairly constant: the sheep and pigs showed considerable decrease each year, but pigs increased in 1919. The horses have slowly increased. Prices rose steadily from 1914–1919.

2. In spite of these vast British supplies, about 100,000 sheep and 400,000 cattle are imported annually, besides some 7,000,000 cwt. of beef and 5,000,000 cwt. of mutton. Owing to increasing population in cattle-raising countries, these supplies steadily decrease (except from Argentina).

Ireland ships every week 5,000 to 8,000 fat and 5,000 to 6,000 store cattle, 3,000 to 30,000 sheep, 500 to 3,000 pigs, to Lancashire ports, Holyhead and Bristol. Scotland sends cattle to the eastern ports. Many of these supplies find their way to London.

QUESTIONS

1. Where and on what do horses, cattle, sheep and pigs live?

2. How far does the number of each kind of animal reflect (1) the relief of the country, (2) the products of each district?

3. Scotland and Ireland are roughly of the same size. Account for the great difference in animal products (*cf.* Fig. 27, p. 87).

TABLE II

The approximate numbers of poultry in Great Britain in June 1908, and of the eggs collected in the year ending June 1908.

	Millions of		Chief Districts.
	Birds.	Eggs.	
Fowls . .	32½	1,108½	Sussex, Bucks.
Ducks . .	3	27¼	Aylesbury, Bucks, Beds.
Geese . .	¾	1¾	
Turkeys . .	¾	1¾	Norfolk, Cambs, Suffolk.
Totals . .	37	1,139¼	

In 1913 there were in Ireland nearly 26 million head of poultry of all kinds, in 1917 only 22¼ million.

Poultry and Eggs worth £25,000,000 were consumed every year before the war in the United Kingdom: of these we imported nearly half—eggs £10,000,000, poultry £1,000,000. British poultry farming has become much more scientific and the produce more valuable. The eggs and plumage of wild fowl and sea birds are important products of the West Coast of Ireland and Scotland.

Beekeeping is common in both England and Ireland. In 1916 there were 30,000 hives of bees, which produced 500,000 lbs. (22 tons) of honey and over a ton of wax.

CHAPTER VI

BRITISH PEOPLES AND THEIR CHARACTERISTICS

A LAND and its people mould each other. A country interests us chiefly as the home of its people, a home which they have developed in their own peculiar way. The people are its most important product. We study it to understand them, their life and place in the world. It is their Motherland. They live in it, love it, and make sacrifices for it. *British life and culture are products of the mingled British races living in British environments.*

Situated on the fringe of the Old World, these islands have been the refuge or the chosen home of many peoples that have wandered westward. For half a million years they have been inhabited. The difficulties of reaching it and its dangers kept out all but vigorous and enterprising peoples. Each new wave gathered to itself the scattered remains of earlier peoples, or spreading peaceably over the land, was absorbed by those in possession.

The British peoples are thus of very mixed descent—the English most so. Contributions from several races and many peoples have built up their physical, mental and moral characteristics and developed their civilisation. Each conquering people developed upon the possessions, conveniences, and indeed the bodies of the conquered. (The slave trade was vigorous until Egbert united England—serfdom, though uncommon in the twelfth century, lingered until Elizabeth's times.) Every people that has lived in Britain has contributed to both British blood and British brains.

The prehistoric peoples laid the foundations of our race and culture. Paleolithic probably, *Neolithic* descendants certainly, are common in the British Isles. Their short stature, long head, dark skin, eyes and hair, betray them whatever language they speak. This Iberian or Ivernian people from the Mediterranean, perhaps from Africa, had already begun to tame and breed animals—the dog, sheep, goat, pig, ox and perhaps the horse; plants—wheat, barley and millet—and fruit trees grew on their plots. They practised simple pottery, weaving and wattling, dressed in skins and coarse woollen clothing and built vast groves and rude temples. Their finely flaked tools are found in the south and east of England, and less commonly in Scotland and Ireland.

The Celts[1] came in two great waves. The Goidels (*cf.* Gaels) arrived about 1000 B.C. They conquered the Ivernians, ruled them probably as slaves and gradually mingled with them. The Celts were tall, well-built, round-headed and fair people, more advanced than, yet able to learn much from, the conquered. Probably their religion and the custom of building stone circles (*e.g.* Stonehenge and Avebury), cromlechs, barrows, etc., were thus borrowed. They were living in the Bronze Age and had begun the mastery of metals. They increased the forest clearings and improved farming. Except the Danes, every conquering people has landed in the south-east, while the former inhabitants have fled to the north-west, where to-day their descendants are found. The Brythons (Britons) arrived at about 500 B.C. This second Celtic people was more advanced. The name means clothed (*i.e.* in cloth). The earlier Celts, who still dressed in skins, retreated north and west, and with them, of course, most of the Iberians. The south of England developed rapidly. The chalk uplands, largely free from trees, became great farms, ploughed by oxen. Wheat, cattle, slaves and dogs were exported; British trade with Europe began, gold coin and iron bars were used for money, and traffic in tin and lead across the Channel and Bay of Biscay to Marseilles became important. The British stored great quantities of corn in barns or in chalk holes, built strongholds (*e.g.* Verulamium), made tracks along

[1] Pronounced Kelts.

the hilltops, and held festivals and fairs at meeting-places, many of which later became the sites of towns.

Their foreign trade, their wealth in gold (from Wales), tin, corn and horses, led to the Roman occupation (A.D. 43). The Celts were brave, generous, energetic but restless, excitable and given to fighting: they were changeable, impatient and lacking in perseverance. In character and in their love of nature, music and romance, of knowledge and religion, they contrast strongly with the plodding, slow-witted Saxons who later seized the British lands—and them. This mingling of races greatly improved the British people. *The British character owes much to the Celt.*

The Romans came to rule and develop their new colony. The Britons were apt pupils and made rapid progress in Roman civilisation. They probably numbered about 1,000,000; the Roman soldiers and colonists about 100,000.

Intermarriage was common. *The Romans laboured for* 350 *years to develop Britain.* They cleared forests, built roads and towns (about sixty); drained marshes (Romney and Fens); mined tin (Cornwall); iron (Weald); coal (Aston); made bricks, fine pottery, salt and cheese; established seaports and carried on an active trade with Gaul in grain, pearls, slaves, horses, hunting dogs, etc. The country became much more productive. They introduced hornless sheep, many fruits (*e.g.* cherry, grape), vegetables and trees (the pine and beech). They brought systematic agriculture and taught the three-fold rotation of crops and introduced manuring of land.

Roman peace and Roman luxury left the Britons unskilled in organised self-defence. In A.D. 499 the *Saxons* began to settle in Kent. Conquest was made easier by the numerous coast approaches and the Roman roads and clearings. The fortified towns gave the Saxons much trouble and were left deserted when conquered. The Saxons, children of the woods, avoided towns and settled in small clearings a mile or two from the main roads (note on the map, p. 186, the villages near the great Roman roads). This was partly for protection. They destroyed much of the Roman culture—towns, mining, manufactures, salt works, etc.—but occupied their farm land and in time reoccupied many of the towns. Much of the Roman work was too permanent to be destroyed—particularly the roads (*cf.* Fig. 30, p. 109).

The Anglo-Saxons were a *Teutonic people* differing in race from the Romans and Celts. They drove out, slew, married or enslaved the Britons. In the south and east, where Roman culture was strongest, probably few slaves were made and the Roman blood and civilisation were largely destroyed. As the conquest slowly moved westward and northward there was more mingling of the peoples.

The first Celtic peoples (Goidels) had long before been pushed to the west and north. Many had crossed to Ireland after, or along with, the Iberians.

In Scotland four kingdoms were founded. (1) A group of Irish Celts called Scots crossed to Argyle and founded there a small kingdom. (2) North of them were the Picts (Ibernians). (3) South-west were other Celts (Cumbrians). (4) Later the Angles colonised the East Coast to Edinburgh. These four kingdoms were afterwards united under the Scots as **Scotland.**

Meanwhile the Saxons, spreading westward, either absorbed the Brythons or drove them into the mountains of Wales, Cornwall and Cumbria, where they long held out against the invader. A Celtic speech is the national language of Wales, another was used in Cornwall until the eighteenth century. The Highlanders of Scotland speak Gaelic, and Erse is still used in Ireland.

The Celts had given names to the chief physical features. As slaves they taught many of these to their Saxon conquerors, especially in the west, where they are used to-day. By this means the former homes of the Celts are traceable in Britain and in Europe. Rivers are most obvious and permanent features, and for a primitive people they are important barriers, boundaries, highways, etc. Almost all British rivers have Celtic

FIG. 25.—THE MINGLING OF RACES

names and contain some form of Celtic words for water—*avon*, *dwr*, *esk*, or *don*. Names of mountains contain *pen*, head; *bryn*, brow; *cefn*, back or ridge (*e.g.* Cheviot); *dun*, hill fortress; *craig*, rock; *ard*, high; *cwm*, combe or wooded valley, and *loch* are other Celtic roots found in British names.

The Saxons settled rapidly in isolated family groups. The names of their villages suggest clearings, as *field*, *hurst* (forest), *weald*, *wold* (wood), *stead* (place); or defensive enclosure, as *ton*, *yard*, *worth*, *bury*, *fold*. Frequently the family name is combined with *ham* (home), *e.g.* Birming-ham, the home of the Birm family. Thus town and village names, especially in the south-east, are Saxon. They are found northward to Edinburgh, and a few are scattered over south-west Ireland (*cf.* Fig. 25).

The new-comers were a sturdy, cheerful, hardworking race; simple, honest, good-hearted and friendly, fond of song and poetry, of eating and drinking, but slow of understanding and unenterprising. Each family and village satisfied its own need, there was little change or progress. Simple farming went on, communication was difficult and even dangerous. Originally free and equal, the Saxon villagers soon became dependent on a leader or principal man, and in the troublous times many became serfs or slaves in return for food or protection.

The Saxons made Britain England, they became English. They gave the country a new stock. Their contributions to civilisation were less important. A few became great scholars, but education and industries developed slowly, they were not lovers of the sea and their trade was unimportant. They destroyed Roman culture in Britain, but their stable, loyal, diligent, homely and good-natured characteristics provided just the necessary balance and steadiness required.

Scarcely were the Saxons settled when the *Danes* attacked the south and east coasts. While closely related to the Saxons and speaking a similar language, they were very different in character. These fierce, energetic, enterprising sea-farers poured into the country and shattered the English kingdoms.

In spite of repulses by Alfred and Athelstan, Danish kings ruled England from 1016 to 1042. The Danes settled in great numbers on the east coast, Norsemen on the north and west of Scotland, in the Isle of Man and on the east of Ireland, where they founded Dublin, Waterford, and Wexford. Their hardy, vigorous stock still makes itself felt there. The English serfs were displaced by these free, independent farmers, whose place names are known by the endings *ley*, *thorpe*, *toft*, *wick*, *garth*, *ford*, *thwaite*. In many parts they mingled freely and peaceably with the Saxons.

The Danes were a bold, hardy race, fond of adventure and discovery; they were enterprising traders and able to adapt themselves to new conditions. Their earlier attacks compelled Alfred to found the English navy; English commerce began to develop soon after. *The Danes poured the love of the sea into our English blood.* From English ports their ships traded all round Northern Europe, and this start was never entirely lost. Like the Saxons they brought excellent national qualities with very little culture. Unlike them they showed great aptitude for adopting the civilisation of their new home.

The British Isles had always been open to sea attack and continued so until the *Normans* came. Of Danish blood, they had the strong qualities of the Danes with the language and culture of the French. Their power of organising men and of building strong castles enabled them to subdue the English, many of whom in the north fled to Scotland. Some 250,000 Normans ruled six times as many English. They brought new blood, new ranks and social customs, new laws, language and taxes. They built new towns, strongholds and churches, but they added little to agriculture, industry or trade. They were great organisers, rulers, warriors, but not farmers or traders. *The Normans brought England into Europe* with all its great civilising influences from which she had been isolated.

The English for a time sank more deeply into serfdom. Danish England rebelled and Yorkshire was laid waste in revenge.

Much of the north was little cultivated for centuries. Later many Normans settled in Scotland. Norman town-names are not common and are easily detected by their French appearance. The habits and customs of the people, the methods of farming and cattle-rearing, changed little. Norman chivalry and religion led to the Crusades, which did much to educate the Norman English.

Ireland felt the early invasions much later than Britain. Some scarcely touched her. The Ivernians were conquered by the first Celts (Goidels) about 550 B.C.; few of the later Brythons went over. Some Celts (the Scots) re-crossed later into Albion (Scotland). Few Saxons reached Ireland, but the Norwegians settled on the east and south coasts in large numbers and founded many ports—Dublin, Waterford, Limerick were the chief. The Normans began early to mingle with the Irish. Henry II. conquered much of the east, and a strong English settlement was formed in and around Dublin. This region under English government was called *the Pale*.

The Norman invasion was the last warlike wave to beat on English shores, but England has always attracted the merchant, the refugee and the enterprising emigrant. These *peaceful invasions*, active before the Conquest, now became greater. The Conqueror brought many Jews and he welcomed Flemings.

The Jews, an alien race common in Europe, were universally hated and were not protected by Christian laws. They had great trading ability and lived in the towns.[1] Many came from Normandy. They were entirely under the king's control and acted as his business agents and money-lenders. He could buy, expel or kill them at will—and often did so. Yet they multiplied. Their safety was in their value to the king and to his nobles. They managed his mines and lent money in his name. Their financial genius and capital were a great help to ambitious kings and enterprising merchants (*cf.* Shylock). Their money developed industries and trade, and made ship-building and over-sea

[1] Read Scott's *Ivanhoe*.

enterprise possible. From these beginnings came great wealth to England, and finally the mastery of the sea and the first place in the world's commerce.

The Jews had special quarters, called Jewries, under the king's protection, especially at London, Oxford, Bury St. Edmunds and Lincoln. They were expelled from England by the king in the fourteenth century, but gradually returned. Many have been absorbed into the British peoples and some have British names. The Jews are foremost to-day among our great bankers, merchants and manufacturers. In recent years they came to us from Poland, Russia and Germany. Many of these are tailors. London and many northern towns, *e.g.* Leeds and Manchester, have large Jewish quarters.

In the later Middle Ages *German and Italian* merchants settled in English ports. The Germans (Hanse League) had great warehouses in the "Steelyard," London, and enjoyed special trading privileges for centuries. They did much for English trade in north-west Europe before they were driven out of London. Italians from Venice had considerable trade in Southampton, and the Lombards practised the banking in London (Lombard Street). They created our trade with southern Europe.

The *Flemish* were akin to the Saxons but were much more skilled in industry and trade. Politics and religion caused many disturbances in Flanders, and for five centuries skilled workmen continued to emigrate to England. William I. planted them on the Scottish (Carlisle) and Welsh borders. They were not happy there, and later moved to Pembrokeshire, where they are distinct from the Welsh to this day. English wool was the best in Europe. Most of it went to Flanders and came back as cloth. Edwards I. and III., to stop this, encouraged Flemish weavers to settle in England. They established weaving in many towns and villages of the east and south, as Norwich, Canterbury, the Cinque Ports, Guildford. *The Flemings helped to make England the greatest cloth-producing country in the world.* In the Middle Ages our wealth and development rested on the wool trade.

Elizabeth welcomed thousands of Flemish Protestants. They taught the English lace-making in Devon, Bucks, Beds, and in the next century, by introducing new crops, they and *the Dutch greatly developed English agriculture.* Religious persecution in France (1685) caused 50,000 *French* Protestants to come to England. They brought capital (£3,000,000), and valuable skill in silk, glass, paper and other manufactures. Many settled in Spitalfields (London). During the Middle Ages the French and Scotch had intermarried very freely.

In Stuart times important migrations to **Ireland** took place. A colony from London settled at Derry and called it Londonderry. Large numbers of Lowland Scotch crossed to *Ulster* at about the same time and established a strong and prosperous colony of Protestants among the Catholic Celts. They have had a great influence on the development and history of Ulster and of Ireland generally. Since 1870 London has become the home of a great many Welsh and Scotch.

There is still a steady stream of immigration to the British Isles. Many who made our free country their new home were *undesirable aliens*—paupers, diseased, criminals, who drifted into workhouses, hospitals and prisons.

The number of aliens who intended to stay in England became so great (30,000 to 40,000 a year) that some restriction was necessary. Under the *Aliens Act* (1905) poor immigrants may land at immigration ports only after examination by immigration officers. Undesirables (poor, diseased, insane or criminals) are not admitted. In 1908 over 170,000 people entered, but the majority passed through to America, etc. The war led to the expulsion of many aliens and stopped immigration for the time.

The English climate and English opportunities have always attracted the restless and enterprising, and often the thoughtful and skilled, from Europe. Every influx has added something to the race—bone and muscle, courage and enterprise, skill and ingenuity, capital and commercial inclination, culture and refinement, creative and artistic capacity. The struggles and enterprises of a thousand years have welded all into a great nation. Saxon and Norman, Dane and Celt, Flemish and French are merged in the **Englishman.** To-day we enjoy the fruits of this blending of peoples and races. Every man whose blood has become British and whose energy has been spent on our soil or our industries, has helped to breed a nation and develop a country that now stands in the front rank.

Progress, often infinitely slow, sometimes astonishingly rapid, has been continuous.

For the past three centuries the British Isles, while receiving thousands of aliens, have sent hundreds of thousands of their best and most enterprising children to America and to **British Colonies.** Ireland has lost half her population. To-day Britons abound in every continent, British enterprise and character are moulding the world and shaping new countries.

QUESTIONS

1. Why are the English the most mixed of the British peoples?

2. After centuries of mingling of races and culture it is often still possible to say to which race or races people belong. Mention the different ways of doing this.

3. In which parts of the British Isles are there people who speak little English, and which races have helped to mould and enrich the English language? Where do we find the most complete mingling of British and foreign peoples?

4. Write a short essay on the causes and consequences of human migration.

5. Account for the differences of the peoples and languages of Carnarvon and Yorkshire, Donegal and Kent.

CHAPTER VII

AGRICULTURE

All culture rests on agriculture, every man depends on the farmer. When primitive man first dropped seeds into scratched soil he became a farmer and laid the foundation of man's greatness.

Man's development depends on his power to control himself and nature. Mastery of minerals, plants, animals, enables people to use them for their own purposes. Agriculture, as a science, teaches man how to control the soil and its vegetable products.

Man has developed agriculture by:

(1) Reclaiming land—draining marshes and clearing away trees and other growth.

(2) Improving the soil—draining or watering, manuring, liming, marling, etc.

(3) Improving his methods and means of farming, *i.e.* his skill and implements.

(4) Improving the products—the variety and quality of the things grown.

Primitive man lacks tools and knowledge. He reclaims little, but lives on nature's open spaces. As he developed in Britain he descended from the open, sunny, dry, safe, but exposed hilltops to the warmer, moister, sheltered and fertile but forest-covered valleys. Ancient Britain was largely forest-clad (*cf.* map, p. 93). The tribes lived on the natural open spaces (Gwents) on the Downs and Wolds (*e.g.* near Winchester, Norwich); they often fortified hills.

The Romans, using tools and horses, could clear and reclaim land. Their fine, straight roads crossed forest, hill, and marsh;

their camps occupied great clearings. They made the first dykes to drain the Fens, the Romney and Thames Marshes, and began to clear the great valleys of the Thames, Severn and Yorkshire Ouse of trees.

The Saxon settlers avoided roads and towns and built innumerable little villages in forest clearings.[1] Note the names: Ac-ton (oak), Withing-ton (willow), Ash-ton and Ash-ham. Name-endings meaning wood are common, *e.g.* shaw, scau (Norse), hurst, wood, holt and field (clearing).

The *Norman Kings* claimed all unappropriated land and made large grants of it. Thus woods and forests steadily decreased. Timber was cut for building and for fuel, but trees were left to scatter their own seed. The care of forests was unknown, they were hunting-grounds and fuel-supplies. William II., however, destroyed many farms and villages to enlarge the New Forest. In the sixteenth and seventeenth centuries the iron industry destroyed the great forest of Anderida on the Weald by using timber and charcoal for smelting.

The Tudors had most of the best land in use for corn-growing or sheep-rearing. The great valleys had long been cleared of forests. In the eighteenth century there was a great development of farming, and vast tracks of open land were enclosed for cultivation.

Marshes require more skill, labour, capital and united effort to reclaim. The Romans began this task but the Saxons neglected their works. The Church in the Middle Ages and many private owners under Elizabeth drained marsh-lands, especially in the east, but the greater works waited for Dutch engineers and Acts of Parliament. *Romney Marsh* (Kent) was embanked and drained by Romans, by Saxons and later by the monks of Canterbury to whom much of it belonged. Marshmen levied money for the upkeep of the sea walls. The formation of shingle banks by the sea has been a great help. This area is now reclaimed and makes good grazing ground for cattle and sheep.

[1] *Cf.* Map of Cambridge District, p. 186.

The Fens lie in six counties around the Wash. Through this vast swamp flowed several rivers. It was overgrown by coarse reeds and other vegetation, and a thick layer of peat was formed. River action gradually silted up this area. Here and there great patches of gravel deposit formed "islands" on which later the first villages and towns were built—Peterborough, Crowland, Ramsey, Ely.

The Romans reclaimed the edge of the Fens, but the Saxons let the sea break in. Monasteries and abbeys were established on the islands and flourished in spite of Danish attacks. In the Middle Ages the monks built causeways, which served as both embankments and roads, and cut canals for drainage and water transport. They had a system for maintaining these defences.

In the seventeenth century a thorough-going scheme was adopted for draining the whole area. The *Earl of Bedford* and other gentlemen agreed to carry out the work. Begun in 1634, it was completed in fifteen years by Dutch engineers. The "Bedford Level" is laid out in rectangular fields, separated and drained by straight dykes and rivers. Straight roads or droves, many of which are still not metalled, lead to the fields. The land is a vast level stretch of black, peaty soil, two to six feet deep, resting on stiff clay. It is extremely fertile, light and easy to work. Commissioners levy rates to maintain the banks and the wind or steam water-mills which pump the water into the rivers. About 500,000 acres of the most fertile land in England were thus re-claimed, and 95,000 acres went to the Earl of Bedford. Most of this land has been recently sold as farms to his tenants (map, p. 260).

Other river estuaries much less valuable have been similarly improved. The lower basins of the Humber, Trent, Orwell, Stour and Thames have been largely reclaimed and brought into cultivation. The Thames estuary (marsh) was several miles wide east of London. Draining and cultivating the marsh lands improved the health conditions of the country around, and reclaimed some of the most fertile land in Europe.

In *Ireland* the mountains lie near the coast. Much of the limestone midlands have been dissolved out, leaving large hollows in which bogs have formed. Many of these cannot be drained. They are covered with a treacherous green, mossy vegetation which produces peat but will not support the weight of man or beast. In many districts peat is dug from the bogs and is the chief fuel. There are 7,000,000 acres of bog in Ireland. (Fig. 81, p. 343.)

In spite of great and successful efforts to reclaim land in England, only one-third is arable. In the Eastern Counties two-thirds of the land is ploughed. (Cambs has slightly more, Norfolk, Suffolk, Lincs and East Riding less, Essex just over half.) Wales has less than one-sixth, Scotland rather more than one-sixth, and Ireland nearly one-fourth of the surface under the plough. (Maps, pp. 86, 87.)

Improving the Land.—Corn-growing soon exhausts land. The primitive farmer discovered this, and when his crop of wheat became thin and poor he farmed another plot. Later when the old plot had rested he found that his corn grew well again. Man cannot easily develop if he moves frequently from place to place, but if land is plentiful, so that some can rest while the other grows corn, then a permanent home can be set up.

This was the *Saxon plan*. A group of related families built their village in the woods. They cleared a large space which was divided into three open fields, A, B, C; each rested a year in turn. Around the fields was a rude belt of cleared but uncultivated grass-land where everyone's cattle, sheep, pigs, geese, etc., fed. Beyond this was a belt of forest which separated the village from others, prevented sudden attacks and supplied wood. The fields were formed on the Roman three-course rotation system which continued in use to the seventeenth or eighteenth century. Field A, grew wheat for bread, field B barley for beer, field C rested. The next year B grew wheat, C barley, and A rested, and so on. Every man had a plot in each field, and he changed his plot each year in case it were better or worse than others. He had the sole use of his plot only from March to

September. In the winter all the live stock of the village grazed on all the clear land. *Thus the land was everybody's and nobody's.* This discouraged its improvement.

After the Conquest, William I. claimed all the land and granted it to his followers, who became the lords of the manors. They in turn shared the rights with their Norman followers and with some Saxons. But usually the lord claimed about half the ploughed land, *i.e.* he cultivated half the strips. He claimed the stream and the water-mill, the meadows beside it and the control of the woods; as time went on he often enclosed parts of the grass-lands for his cattle. But no one *owned* the strips; and no one cultivated the open grass-land, because it was everybody's. There was little hope that farmers would do much for the land unless they owned it or could rent it permanently.

Enclosure is not necessary to private possession, but in England the two came together. The *Black Death*, 1348, hastened the change. Half the population of England died, labour was very scarce and wages high. English wool made very high prices. Sheep-rearing was much more profitable than farming and required very little labour. But sheep and corn could not be raised together on the open fields. The lords began to enclose land in spite of the king's laws and the peasants' riots. Meanwhile, woods were gradually being cleared and commons enclosed.

The *Dissolution of the Monasteries* was a great blow to agriculture. The monks held one-fourth of all the arable land. They owned their land; they had time, money, knowledge and labour to improve it. They treated the labourers well. The Dissolution was like a " new conquest," for it distributed vast estates among the king's favourites or purchasers who had no interest in the labourers, in farming or in the land, except as a source of income.

Hence much of this land became sheep-runs. But soon sheep-farming became less profitable. More corn was grown and enclosing was stopped until the *revival of agriculture* in the seventeenth and eighteenth centuries, when enclosing seemed necessary for improving the soil.[1] From 1700 to 1850 over 4000 Acts of Parliament were passed, *enclosing over* 7,500,000 *acres*. The enclosed land was distributed among the villagers. But the small-holder had neither money nor knowledge of the new methods of farming. He often sold or rented his plot and moved to the towns where labour was wanted for the growing industries. Many other yeoman farmers gradually sank into farm labourers. Thus land got into fewer hands, and "landed gentry" became very powerful in Parliament. To-day efforts are made to reverse the process—to break up big estates and bring men back to the land as "small-holders."

Enclosure increased the wealth and power of the lords of manors. Many enclosures were wrongly made. After 1850, Parliament opposed enclosure. *Many enclosures were declared illegal* and were thrown open.

The City of London compelled certain lords to free 3000 acres of Epping Forest which they had enclosed. Common lands to-day are comparatively rare, but it is still often necessary to fight against enclosure of commons, open spaces, footpaths, etc.

But the last period of **enclosing revolutionised farming.** Men now owned or leased their land and felt safe in spending money to improve it by fencing, draining, marling, liming, manuring, clearing, making roads, building farms, employing more horses and men, learning new methods and purchasing implements. In the eighteenth century, many nobility and gentry made farming their first interest. Rapid progress was made. The yield was doubled, and England for a time was able to feed a rapidly growing population and *still export corn*.

Industrial development, however, drew more and more men from the land, and agriculture declined, town population increased rapidly, our colonies and other countries began to send us cheap food, and to-day we depend on our imports for about three-quarters of our food. To remedy this, efforts have been

[1] The open fields common in foreign lands show us that enclosure is not essential for good cultivation.

made to encourage the people to stay on or return to the land. In 1887 the *Allotment Act* was passed. It gave local authorities power to buy or hire land and let it, in small parcels of not more than five acres, to labouring men or women. In 1908 the *Small Holdings Act* made it possible to hire or purchase by instalments from the County Council up to fifty acres. The holders must themselves cultivate the small holding. Norfolk claims to stand first in small holdings. In 1920 it let 3220 allotments of 1–5 acres, and nearly 6000 small holdings (5–50 acres).

In 1920 there were in England and Wales nearly 14,000 farms of over 300 acres (25 per cent. of the farm land), but 81,000 of allotment size (1–5 acres) and 194,000 of small-holdings size. Though 275,000 in number, these small farms only cover about 15 per cent. of the agricultural land. During and since the war many large estates have been broken up and sold to farmers, and small holdings have greatly increased in number.

Scotland has nearly 18,000 farms of 1–5 acres, 34,000 of 5–50 acres, 73,000 of 50 to 300 acres, but not 3000 of over 300 acres. The average Scotch farm is about 60 acres.

In Ireland much more has been done. The Act of 1881 helped tenants to rent, and those of 1891, 1909 and 1913 to buy, small farms, with the result that over 11,000,000 acres, more than half the available land, have been bought by peasant farmers. In 1917 there were over 10,000 farms of over 200 acres each, but 560,000 of less than 200 acres; of these 150,000 were not over 5 acres.

Enriching the Soil.—Soil quickly becomes poor unless it is well manured and rested. Crops rob it of important salts. Vegetable and animal refuse is useful in restoring these to the land. It is only during the last century that agricultural science has been able to *analyse the soil* of a farm or field and say just what is required to enrich it. A mixture of clay, sand and chalk makes a good soil. Clay alone is stiff and heavy to work, and holds the water. Sand alone is poor, shifting, and holds no water. Chalk alone is also dry and poor.

In nature, plants decay or are consumed on the spot, and the plant and animal refuse as manure restores the food to the land. This is still done where animals feed on the land; hence the value of root crops. Civilised man, however, congregates in towns. The refuse does not find its way back to the land, but is destroyed and wasted. Hence artificial or chemical manures are manufactured in concentrated forms and guano is imported. Refuse from iron and gas works, decaying fish and seaweed are strewn on the land in some districts. One of the best ways of resting and restoring the land is a careful sequence of different crops which draw different substances from the land and sometimes produce other foods in the soil for the next crop.

Improvements in Methods, Implements and Products have been great during the last three centuries. Under the *Normans* about half the land was uncultivated every year. Crops averaged about six bushels per acre, to-day the average is thirty-two bushels. (*Cf.* Table III.) The grass was thin and poor, cattle were ill-fed and small, they weighed, when killed, a third of the average weight to-day. There was little or no hay for the winter, most animals were killed and salted. Man understood little of his own needs, or those of his land and his cattle. His food lacked variety; much meat, salted with sea-salt, brought on leprosy and other diseases.

Wheat was the staple food. About one quarter (eight bushels) of wheat per annum is necessary per person. *Population was definitely limited by the amount of wheat produced*, for little or no corn was imported. "There were generally as many people . . . as there have been on an average quarters of wheat to feed them with."[1] The population of England in the Middle Ages was two to three millions. The improvement of agriculture later was thus closely connected with the growth of population (*cf.* p. 183). To-day foreign supplies help to make up the required amount.

The monks noticed that different crops took different foods from the soil, and that when land is "wheat starved" it will

[1] Rogers.

grow peas quite well. But the three-course rotation went on until many important **new products** and **new methods** were introduced by the Dutch and Flemish farmers. They showed how the fallow or resting year could be used to grow "roots," an excellent winter food for man and beast.

Roots—mangolds, swedes, turnips, carrots—planted in wide rows permit the land to be thoroughly cleaned. They leave the land ready for wheat, and as they are eaten by cattle the farmer has plenty of manure for the land. In the seventeenth century potatoes were introduced, and in the eighteenth century the *green foods*—clover, sainfoin, ryegrass, lucerne, etc. Clover is an excellent preparation for wheat. Its long roots prepare and leave in the soil the food required by wheat. Most of the green fodders will grow for several years on the same field and can be cut several times during the year.

The Dutch not only gave us these valuable new crops but used them to make a *four or even six-course rotation* thus: fallow (*i.e.* roots), barley, clover, wheat. The "fallow" year, being under roots, both cleaned the land and produced a valuable crop for cattle and horses. Population in the eighteenth century began to increase rapidly, but corn-growing on the new plan more than sufficed, and much was exported. The English gentry gave close attention to agriculture, which became more flourishing than ever before or since, for prices were still high. In the fourteenth century the production of wheat was about five bushels per acre; in the seventeenth, ten bushels; in the nineteenth, thirty bushels.

In the nineteenth century *scientific study* discovered what each crop took from soils, and **artificial manures** are now made to supply the necessary chemical foods. Colonial competition, however, began to be felt, for wheat can be easily and cheaply grown on virgin soils. The greater part of our wheat and flour is now imported. British farmers have therefore largely turned to other crops or other uses of land. (See Tables I. and II.)

To-day experiments are made with plants and seeds from all parts of the world so that those suitable for British climate and soils may be cultivated. America has given us potatoes, tomatoes, maize and tobacco. Maize does not ripen in England, but is cut green for cattle. British tobacco-growing is still in the experimental stage.

Cattle and horse-raising was a valuable alternative to wheat-growing, but foreign cattle and meat are now imported in great quantities and the use of motors has much lessened the demand for horses. Even much farming is now done by tractors.

The relation between cattle-rearing and corn-farming is important. Farmers need horses, cattle and sheep to eat up the green and root-crops and provide manure. They need horses to work on the farm. Meat, milk, butter, cheese and wool are important products. Good corn-land will generally pay much better under corn than under cattle, but the latter require little labour, hence when *labour* is scarce and dear and corn prices are low, more grass is cultivated. As the price of corn rises, grass-lands are ploughed up again.

Apart from bread, meat and dairy foods, *the needs of a dense population* cannot readily be supplied by the colonies or distant agricultural countries. Vast quantities of potatoes are grown in the Fens and sent to London and the north. Fruit farms occupy whole districts in Cambs and Worcestershire, in Kent and Surrey. Strawberry beds cover many acres in the warm south (Kent and Hants) and in the Fens. Dairy farms produce millions of gallons of milk, and market gardens grow all kinds of vegetables and flowers, within a sixty-mile radius of London and other large towns.

In the last fifty years *horticulture* has become an important industry and a valuable source of food supplies, especially of vegetables and fruit. Intensive culture gets two or three crops on the gardens in a year. There are now about 3000 acres of glasshouses (for early vegetables, fruits—grapes—and especially tomatoes), which cost £4000 per acre to build and equip for heating, etc. Many acres lie in the Lea Valley (Waltham Cross, etc.), north of London.

In the North, the Midlands and South Wales, whole valleys and great tracts of plains are given up to collieries, factories, and to the villages and towns in which the workers live, while *much land is rendered useless by waste products*, *e.g.* gases, refuse, etc., of the local industries.

Efforts are being made to use waste lands on moors and mountains either for forestry or farming, and to make farming generally more productive so that we may be less dependent on colonial and foreign supplies. There are now agricultural colleges and experimental farms, where young farmers are trained. These and the Board of Agriculture give valuable help to farmers.

Agriculture has been carried on in the British Isles for over 2000 years. Most of the suitable land has gradually been cleared and improved and is now in cultivation. (See Table I. and Fig. 23, Chap. IV.)

Agricultural Implements have become very complicated and costly. While labour was ample and cheap the methods of farming changed but little. *All farming processes were formerly done by hand.* The Saxons and Normans used oxen for ploughing and for carting the corn; later, horses were employed—they work faster. To-day steam is much used, and now the motor tractor ploughs and reaps. Thus the work is cheapened and hastened. Time is particularly important in sowing and reaping. A steam plough travels at the rate of four or five miles per hour and raises four to six furrows (*i.e.* a four or five foot strip) at once. Deep ploughing and draining can be done only by steam. Horses in drilling (sowing the seed) and hoeing, reaping and binding, do the work of several men at much greater speed. A steam tackle thrashes and cleans the corn, leaving it in sacks ready for the market. Heavy steam machinery is often owned by a machinist and hired by the farmers. Thus the number of hands required to-day on a 1000-acre farm is but a fraction of those employed in Norman times. Yet the land is cleaner and the yield many times greater.

While the newer methods and implements are rapidly spreading, the old linger on, especially on poor soils. Oxen plough and harrow in Sussex. Men still sow broadcast, reap with the sickle or mow with a scythe, and thrash with the flail.

Many industries depend on Agriculture. Important factories for implements, unlike most works, are often found in towns in the heart of agricultural districts, *e.g.* at Bedford (ploughs, harrows, drills, etc.), Ipswich (reapers and binders and grass mowers), Grantham and Lincoln (thrashing machinery), Banbury (farm machinery), and Leeds (heavy steam ploughing and cultivating implements).

The Straw-plait Industry is still largely a hand occupation and has developed in the towns and villages of Beds and Herts, where the young wheat-straw is specially suitable. The plait made in the villages is handled and worked up in the towns near, *e.g.* Luton, Dunstable, which are in easy communication with London. But most of the straw plait now comes from China and Japan.

Other industries have now retreated to large towns, or have broken their close connection with agriculture. *Milling* has deserted the old windmills for extensive and elaborate steam mills at the ports of entry for corn, *e.g.* London, Liverpool, Barry, Hull. Even modern steam mills, as at Cambridge and Huntingdon, find it difficult to compete with those others. *Tanneries* are now found in London, Birmingham, etc.—large towns where many cattle are slaughtered.

The Woollen Manufacture was originally carried on by handlooms in the villages of sheep-rearing districts, especially on or near such chalk hills as the Downs, Chilterns, Cotswolds, and Yorkshire Wolds, Worcestershire, etc. The first factory was set up in Newbury in Elizabeth's reign, and others were built in the south at Bradford, Trowbridge and Stroud. The modern use of great machines, of coal and of colonial wool, has caused most

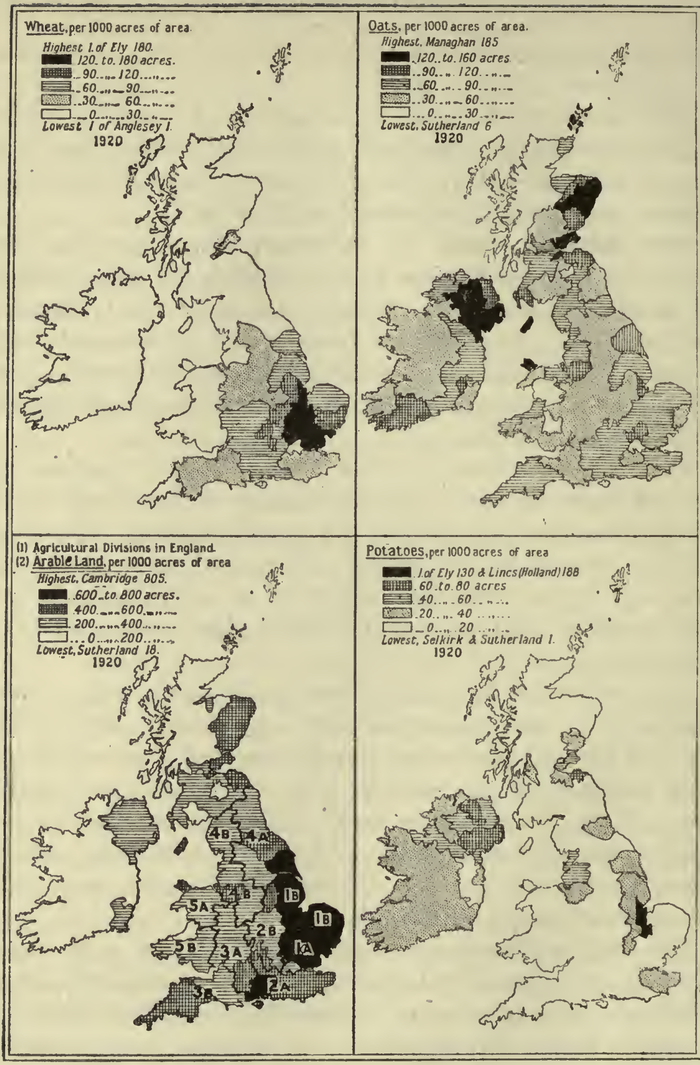

FIG. 26.—MAPS SHOWING THE DISTRIBUTION OF ARABLE LAND AND OF THE CHIEF CORN CROPS

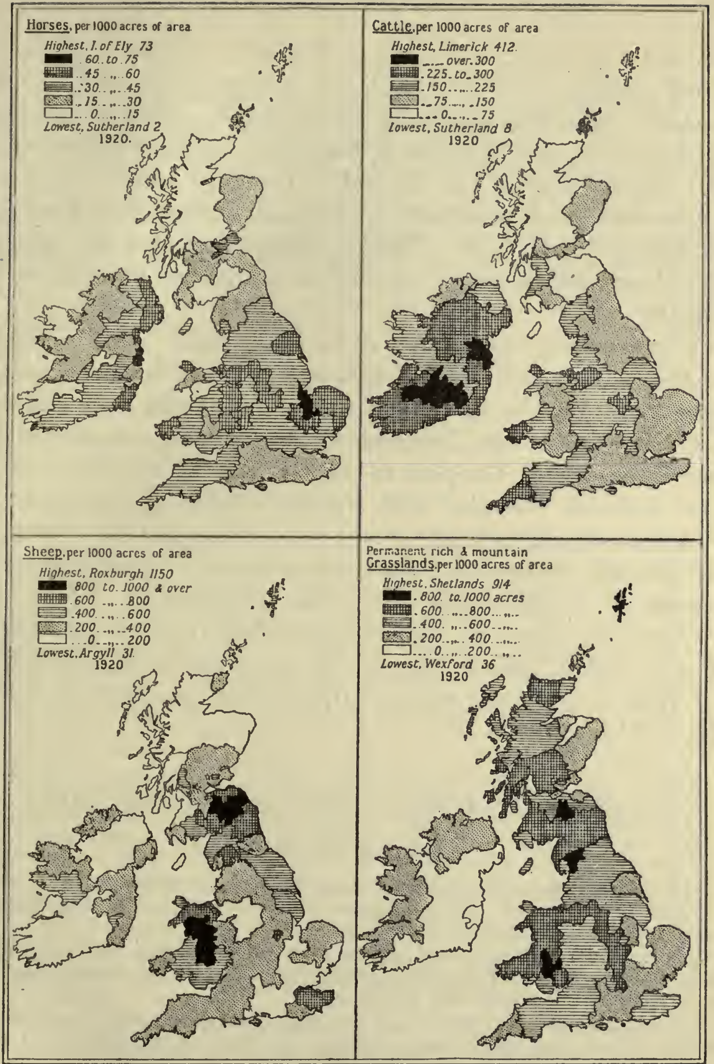

FIG. 27.—MAPS SHOWING THE DISTRIBUTION OF GRASS LANDS AND OF THE CHIEF ANIMAL PRODUCTS

woollen manufactures to move to Yorkshire. Similarly *flax* and *hemp industries* are now housed in or near Irish and Scotch seaports where flax and hemp are imported. *Bread* is required freshly made, and therefore is baked in each town and village, but *biscuit* factories are situated in the large wheat and flour ports—London, Bristol, Cardiff, Liverpool, Glasgow. The Reading works, situated in the Thames wheat-lands, are too highly developed and strongly established to decay through such change.

Cheese-making was introduced by the Romans. It is a means of storing a valuable animal food and is found in most grazing countries. Many localities, *e.g.* Cambs and Hunts, once famous for cheese, have lost their industries. Foreign competition is one of the causes. The plain of Cheshire and the Yorkshire Dales and Somerset (Cheddar) still produce cheese of fine quality. This industry cannot easily escape from grazing districts. To-day agricultural colleges and dairy schools exist to train men and women to manage farms and dairies scientifically.

The chief crops now cultivated and their extent are shown in Fig. 26 and in Table I., the success of British farming (Yields) in Table II., and the value of the different products in Table III., which follow.

NOTES ON THE FARMING AND STOCK-RAISING MAPS

(FIGS. 26 AND 27)

1. Compare the arable land and grass land maps with each other and with Fig. 22. Note the physical reasons (relief and soil), for the distribution of arable, grass and unproductive land.

2. Compare the wheat land map with Fig. 28, Chapter VIII., ancient forests and marshes. Refer also to the graph, Chapter IV. and to Chapter III. (climate) to explain the wheat map.

3. Compare the grass land map (especially permanent rich grass areas) with the oats and barley maps, and account for their similarity and for their difference from the wheat map.

4. The domestic animals next in importance to sheep are *pigs*. The numbers in 1914 were, England 2,280,000, Wales less than 200,000, Scotland about 150,000, Ireland 1,305,000. In 1920 the numbers were much smaller.

EXERCISES

1. Judging from the maps, are horses bred most on grazing farms or on arable land? Explain why it should be so, and state which kinds of horses are bred in grazing districts, and on what kind of grass.

2. Why are oats the most valuable and most commonly grown British cereal?

3. Draw a sketch map showing where "mixed" farming (producing corn and roots, cattle and sheep) is largely carried on, and where it is (*a*) impossible, (*b*) less profitable than (1) cattle or sheep-raising, and (2) growing corn and roots.

4. On which kinds of farms are pigs mostly reared? Explain the small numbers in Wales and Scotland.

TABLE I

The distribution of Corn, Roots and Hay in the United Kingdom in 1913.

	England and Wales.	Scotland.	Ireland.	Total Acres.	
	1000 acres.	1000 acres.	1000 acres.	In Thousands.	In Millions.
Wheat (*a*)	1,702	55	34	1,791	$1\frac{3}{4}$
Barley	1,559	198	193	1,950	2
Oats	1,975	938	1,049	3,962	4
Peas and Beans	432	6.2	1.5	439.7	$\frac{1}{2}$
Potatoes	442	149	582	1,173	$1\frac{1}{4}$
Roots (*b*)	1,475	434	356	2,265	$2\frac{1}{4}$
Hay (*c*)	6,770	575	2,482	9,827	10

(*a*) The introduction of foreign wheat, by reducing the price, decreased the wheat area from 4,000,000 acres in 1867 to about 1,800,000. The acreage varies considerably from year to year. In 1918 England sowed 2,557,000 acres of wheat, but in 1920 this fell to 1,875,000, which is near the pre-war average. It is sufficient to remember the approximate acreage.

(*b*) Turnips and swedes are hardy and are grown everywhere. Mangolds are little grown north of York and Dundalk.

(*c*) Hay is grown everywhere. England crops nearly three-quarters of hers from permanent grass, Ireland three-fifths, Scotland little more than one-quarter. The remainder is cropped from grass, clover, etc., sown on arable land.

EXERCISES

1. By comparing Table I. (above) and Table I., Chap. IV., find the percentage of arable land devoted to cereals in England, Scotland and Ireland respectively. Show this in a diagram.

2. What proportion of the arable land grows potatoes in each country?

3. How is the life of the British people affected by the two million acres of roots grown annually?

TABLE II

Total produce and yield per acre of the chief British Crops in 1913.

	England & Wales.		Scotland.		Ireland.		Total Crops.	
	Crop. 1000 qrs.	Yield. bush.	Crop. 1000 qrs.	Yield. bush.	Crop. 1000 qrs.	Yield bush.	Quarters 1000	millions (*approx.*)
Wheat .	6,642	31.2	283	41.3	163	38.1	7,088	7
Barley .	6,323	32.5	921	37.2	960	44.4	8,203	8
Oats .	9,378	38	4,502	38.4	6,779	51.7	20,660	21
Beans .	915	28	28	37.4	7	46.4	950	1
Peas .	422	26	.6	24.8	8	30.9	424	·5
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Potatoes .	2,895	6.6	971	6.1	3,739	6.4	7,705	8
Turnips } Swedes }	12,794	12.2	7,336	17	5,189	18.6	25,319	25
Mangolds	7,611	18.2	36	20	1,629	20.6	9,276	9
Hay .	9,052	1.5	856	1.6	5,396	2.1	15,304	15

1. In 1919 the wheat and oat crops were about 1,000,000 qrs. heavier, but other crops were generally lower. In 1920 the crops were more normal.

2. Returns are issued each year by the Board of Agriculture for each country. The Irish corn returns are given in cwts. The weight of different kinds of corn varies according to quality and dryness. The standard weights per bushel are—wheat 60 lbs., barley 50 lbs., oats 39 lbs., peas and beans 63 lbs. The Irish returns have been converted into quarters and bushels (1 qr. = 2 sacks = 8 bushels).

EXERCISES

1. Are more oats grown than all other kinds of corn? Compare the *weights*, not the measures.

2. Compare the values of the total wheat, oat and potato crops (*cf.* Table III.).

3. Where is hay largely grown? Why do not farmers grow more wheat, oats or potatoes?

TABLE III

Average yields and pre-war prices of the chief British Crops.

	England and Wales.	Scotland.	Ireland.	British Isles.	Pre-war Prices. per qr. s. d.
	Bushels per acre.			*Average.*	
Wheat .	31.3	39.7	35.8	35.3	32 6
Barley .	32.9	35.7	38	35.5	24 0
Oats .	40.6	37.4	48	42	19 0
Beans .	29.8	35.7	40	35.2	48 0
Peas .	26.7	27.8	26.5	27	48 0
	Tons per acre.				*Prices per ton.*
Potatoes	6	6.4	4.8	5.7	70 0
Swedes and Turnips	13.2	16.4	16.7	15.4	22 0
Mangolds	19.5	17.9	18.5	18.6	17 6
Seeds' Hay	1.5	1.6	1.9	1.7	77 6
Meadow Hay	1.2	1.5	2.1	1.6	67 6

1. Crops vary widely in yield and price from year to year. The yield in 1913 was poor, in 1914 very good. When the total yield is low the price usually runs higher. Yield also varies much in different districts. The best wheat or potato land in a good year will produce almost double the average given in Table III. Poor lands yield less.

2. Prices vary in different markets and seasons. Those given are returns for London markets, week ending 4th March, 1914. In 1917 wheat had risen 132 per cent., barley 128 per cent., oats 151 per cent., potatoes about 137 per cent., cattle foods about 150 per cent. In 1919 prices were higher still, but began to fall in 1920. They are likely to be permanently higher.

EXERCISES

1. Find to the nearest million pounds the value of each crop given in Table II. Make a diagram to show your results.

2. Compare the total value of the animal foodstuffs in Table II. (including the peas and beans and 10 per cent. of the potatoes) with that of the human foodstuffs.

3. Construct a diagram to show the average return value (gross) per acre of each kind of crop.

CHAPTER VIII

FORESTRY

Forestry to-day has become a science and is practised much more in some countries than in the British Isles. England was a land of forests. The great forest of Anderida on the Weald was 120 miles long. Other great fragments of the primeval forests were, New Forest, Forest of Wyre on the Severn (*cf.* Forest of Dean to-day), Forest of Arden along the Avon in Warwickshire, a forest from London to the Wash, Forests of Rockingham and Charnwood in the Midlands, Brunowold in Lincs, Sherwood and Needwood in the Trent Valley from Peak to Humber, great moors and forests from the Peak to the Wall, Selkirk and Ettrick beyond.

The present forests in England are Epping Forest (Essex) near London, Sherwood Forest (Notts), Forest of Arden (Warwick), and the *Crown Forests* (nearly 67,000 acres) which include Dean Forest (16,000 acres), Gloucestershire, New Forest (23,000), Hants, Windsor Forest (10,000). The Forests of Dartmoor and Exmoor, the *Wolds*[1] of Yorks and Lancs, and the *Weald*,[1] are merely names of regions where forests once stood. But the Weald is still a beautifully wooded region. Sussex has 13 per cent., Hants 12 per cent., Surrey 11·8 per cent., and Kent 10 per cent. of land under timber. The deer forests of the north of Scotland are mostly vast moors, with few trees. (*Cf.* Fig. 22.)

Aberdeen, Inverness, Perth, Ross, and Elgin have large areas of forest. In 1913 over 3,500,000 acres in Scotland were "exclusively devoted to sport," at a rental of £180,000 a year.

The uses of forests are varied. Formerly domestic animals

[1] Wold and weald mean wooded hills.

fed on the mast (acorns and beech nuts); forests were the chief source of fuel for rich and poor, and provided timber for building both houses and ships. Charcoal-burning was an important industry, especially in the west of Scotland, the Lake District, on the Welsh Borders, and in the Weald. Charcoal was used for iron-smelting until the seventeenth century.

To-day woods have little effect on the climate of Britain, but in sandy districts they hold the soil in place, and on steep mountain sides they prevent floods, erosion and rapid evaporation. Woods protect crops growing near them from storms and cold winds, but they harbour many kinds of small animals (rabbits and birds) which damage the crops. Woods and forests have their own beauty and give character to the hillside and to the landscape. Their chief value, however, lies in the timber which is produced.

FIG. 28.—ANCIENT FORESTS AND MARSHES

Till the end of the Middle Ages England was a naturally overgrown country. Only yews (for bows) and oaks (for ships) were cultivated. Under the Tudors there was a great development in building houses and ships. This rapidly used up the best timber, but was not accompanied by tree-planting During the Civil War the destruction of forests went on even more rapidly. At the end of the eighteenth century the demand for oak for the navy was so great that the State had to plant large areas. In 1810–23 some 50,000 acres were planted. Soon after this, however, the use of timber (hard) in building houses and ships rapidly diminished and planting was stopped. Meanwhile great areas had been planted with pine in Scotland. In fifty years these trees were ready for use and were cut down, but the cheap, imported timber made replanting seem unprofitable.

During the war more than a tenth of the timber areas were cleared (470 square miles—nearly the size of Bedfordshire). In 1919–20 about three times as much timber was cut as in 1913–14, and was worth five times as much, *i.e.* 2,000,000 loads valued at £5,000,000. It is likely that we shall have to depend much more upon home-grown supplies than in the past. At present we have a smaller percentage of surface under trees than any other European country.

AREA AND OWNERSHIP OF EXISTING WOODS AND FORESTS IN SQUARE MILES

	State.	Corporation.	Private.	Total.	Per cent. of total surface.
England and Wales .	102	54	2,784	2,940	5
Scotland . . .	2	1	1,777	1,780	6
Ireland . . .	30	—	430	460	1.5
Total	134	55	4,991	5,180	4·3

There are at present about 5180 square miles, or over 3,000,000 acres, under timber in the United Kingdom, and we need about 12,000,000 acres to supply our needs. This would cover 15 per cent. of the total surface and would occupy some of the present waste lands and unproductive grass-lands. The present yield is about 30,000,000 cubic feet, *i.e.* nearly 800,000 tons of timber worth £1,000,000. Our pre-war annual imports were over 10,000,000 tons of timber worth £27,500,000, besides wood manufactures and timber products valued at nearly £13,000,000. During 1915–16 we paid £35,000,000 more than the pre-war prices and used 7,000,000 tons of shipping. Now we import about £40,000,000 worth of timber.

The Timber Industries give employment to over 750,000 persons, including woodmen (16,200). Those engaged in making furniture, boxes, carts and wagons, brushes, baskets, produce annually goods worth over £46,000,000. Timber industries—sawpits, carpenters' shops, tan yards, builders' yards—once found in every village are rapidly disappearing from the country into the towns where steam and water power are available and modern machinery can be installed; where the collection of timber and the distribution of produce can be quickly and cheaply done by rail or water. Furniture is made in large works. The big chair-factories of High Wycombe are a modern development of an early cottage industry arising out of the great beech-woods of the Chilterns around the town. Much of the work is still done in small (home) workshops. Much of the joinery needed in building is supplied "ready-made," often by Sweden. Boats, fishing boats and wooden ships are now built chiefly in a few large ship-building yards.

The Forestry Act of 1919 set up a Forestry Commission for the United Kingdom, and made a grant of £3,500,000 for the next ten years. The eight commissioners can buy land and timber, assist owners, supervise woods, train foresters, and assist afforestation in every possible way. It is intended that 200,000 acres shall be planted in the next ten years. Although the State and corporate bodies own most of the best-known forests, the greater part of forests and woodlands are privately owned. Town corporations are now planting their water catchment areas with trees to ensure greater and purer water supplies. As afforestation gives no returns for fifteen to twenty years, and plantations of fast-growing soft woods scarcely become self-supporting in less than forty years, and at their best in eighty to a hundred years, there is not much encouragement for private enterprise.

The manufacture of paper, artificial silk, wood "wool," buttons, celluloid, gun-cotton, and chemicals from wood-pulp, sawdust and shavings is largely carried on in countries where suitable fibrous pines, spruce and poplars grow in vast numbers, but we import from Norway and Sweden some 6,000,000 tons and from Canada and Newfoundland 1,000,000 tons of wood-pulp for paper-making.

Many **British Trees** are indigenous, and their growth is still largely natural—wild. Remains from lake dwellings and peat bogs (*e.g.* Fens) show that for ages the alder, ash, aspen, wych elm, hazel, oak, Scots fir and yew (the only two conifers) were common. The *Romans* gave us the beech, lime and poplar, and the cherry, grape, pear, plum, chestnut and walnut. The larch was introduced in the seventeenth, the Weymouth pine in the eighteenth, the Douglas fir in the nineteenth century. The indigenous forests consisted of trees fitted to grow in the soil on which they were found. In the river valleys were willows, alder, ash, poplar. On dry sandy soils, as on the heaths of Surrey, Hants and Dorset, grew the oak, beech, birch and Scots pine. On the hills of Wales, northern and western England and southern Scotland were great forests of oak. Pine trees grew in many parts, especially in the Highlands. Beech-woods covered the chalk downs of the south-east of England and the Chilterns. Ash-woods grew on the limestone of Somerset, Derbyshire and Ireland. Oaks covered the clay lowlands.

Most of these forests have disappeared or have changed in character. Modern forestry frequently substitutes more suitable or profitable trees, and many large tracts have become pasture or corn land. Large beech-woods persist on the Chilterns. Near them is High Wycombe, the centre of the chair-making trade. Oaks are common in Northants and the Weald. Mixed woods —broad-leaved and conifers—are found in the south and east (Kent, Surrey and Sussex have 20 per cent. of the woods in the country). The Scots pine grows on the sandy soils of Surrey and Hants, and larch on the hills of the south-west and west of England, and Scotland. On the east of Scotland, the Scots pine is common. The south of Ireland is well wooded, chiefly by conifers, especially the larch.

Timber is classified as (1) *soft woods*, obtained from the conifers — Scots and Weymouth pines, Silver and Douglas firs and the Larch and

Spruce; (2) *hard woods*—Beech, Oak, Sweet Chestnut, Birch, Ash, Elm, Poplar and Sycamore.

The soft woods grow rapidly and, at 50 years, range from 50 feet (Scots) to 100 feet (Douglas fir) in height and yield 4300 to 6500 cubic feet per acre. The Scots pine (red deal) is "the most important timber in Europe." It has many uses both in and out of doors and in the pits. One kind is light and strong, and is used in aeroplanes and furniture. Larch timber is very durable and is much used out of doors for fencing, posts, pit-props, breakwaters, boats, carts, but is not easy to work. It is one of the most important of our forest trees. The Weymouth pine gives a light soft wood which shrinks very little. It is used for pattern-making and matches. Norway spruce (white deal) is used chiefly indoors for building and for wood pulp. It will grow high up the hills, and yields very much better than larch or Scots pine. The Douglas fir, recently introduced, grows very rapidly and yields very heavily. It is likely to be much planted in this country. The annual value of British soft wood cut for sale, not including pit wood, is about £350,000; the hard wood is worth £400,000. About 5,000,000 tons of pit wood is used in our coal-mines, chiefly props three to six inches thick and three to six feet long. Scots pine, spruce and larch are largely used—the last is much the best and most lasting, but costs more.

Of hard woods, the oak, sacred to the Druids, is our national tree, and is king of both forest and field. It has deep roots, grows well on clay, but best on loamy or sandy soil, and lives long. The bark is very valuable for tanning, and is stripped from young trees (fifteen to eighteen years old), but its timber is best at ten times that age. The wood is very hard, strong, and durable, is beautifully marked or "figured" and takes a fine polish. Hence it is much used both for building ships and houses, and for furniture and decoration. It is to-day the most generally useful of all hard woods.

The ash and elm, both hedgerow trees, are very useful. Ash wood, ready after thirty or forty years' growth, is tough and elastic, and is therefore used in the frames of aeroplanes, carts, waggons and many agricultural implements, and for tool handles. It is easily steamed and bent for use in racquets, hoops, wheel rims, and hockey sticks. The elm lives long and grows tall and thick. Its broad, finely marked planks are used to fill in framework, and for chair bottoms, strong boxes and parts of ships and barges. The ash is often seen in woods, and both trees grow also in high and cool altitudes.

The beech is a beautiful tree. Formerly many animals, domestic and wild, fed on its mast (nuts), and its wood was burned or made into charcoal. It is used indoors for furniture (chairs) and especially for turning, *e.g.* chair legs, wooden platters, tool handles. It can be steamed and made into bent-wood furniture. There are large beech woods on the Chilterns and South Downs.

The birch is a very graceful tree, with a very beautiful bark often used for tanning. It will grow in high altitudes and cold climates. Its wood is used for indoor purposes—chairs, furniture, clogs. The poplar is also beautiful, but it grows rapidly. Its wood is light and tough enough for boarding carts and waggons, and making packing-cases. When large it is used for ply-wood and matches. Alders, willows, and osiers grow beside rivers. Alder wood is hard and durable, willow is light and tough (cricket bats). In strips it is used for basket-making and its bark for tanning. Osiers are made into baskets.

Cherry wood (red) and box (yellow) are hard, fine-grained woods used for furniture. Cherry-wood sticks and pipes, and box-wood rules, handles, cups, balls, are common.

EXERCISES

1. Why are landowners unwilling to plant large areas with trees? What other objection has a tenant to doing so? How does this affect the forestry of the British Isles?

2. Why is most Elizabethan and Jacobean furniture made of oak? Why is bog oak (quite black) frequently found in the Fen land and marshes but not other kinds of fallen trees?

3. Name the qualities and describe the uses of the beech as (*a*) a tree, (*b*) timber.

4. What use is made of light, soft and fast-growing timbers?

CHAPTER IX

FISHERIES

"*Fishing, next to agriculture, is the greatest of British industries,* judged by the number of men engaged, the amount of capital invested, and the importance of the product to the food of the people. . . . The total number of whole-time fishermen is 125,000, while there are as many half-timers. Taking the whole industry, fishermen, curers, distributing agents, etc., it may be estimated that it gives support to one-twentieth of the population, while the capital sum directly invested must be about £200,000,000." [1]

The British sea-fishing industry is the best manned and equipped in the world. It supplies the country with most valuable food at a very low price (pre-war, landing price 1½d. per lb.). The yearly consumption is meat, 2,500,000 tons, fish, 7,000,000 tons. Unlike farming, fishing pays no rent, rates, taxes, neither ploughs nor sows (but something is done in preparing, feeding and stocking fishing-grounds). It only reaps; and while certain kinds of fish are seasonal, deep-sea fishing is a perennial harvest. Even the offal (heads, etc.) and decayed fish are sold to make fish meal, manure or chicken food at £10 per ton (pre-war).

British fisheries have grown steadily in range and importance. At first limited to fresh-water fish—salmon, eels, trout, pike, etc.—and shellfish, especially oysters, they have steadily expanded, first to coastal and now to deep-sea fishing over a range of 3500 miles from the White Sea and Iceland to the south of Morocco.

The Romans made Colchester oysters famous. The Saxons

[1] Prof. Gardiner in *The Geographical Journal.*

often paid the monks eel or salmon rents for their lands. But the Normans first developed the industry, fishing with net and line as far as Iceland. The great, sandy beach of *Yarmouth* came into use. A fishing colony was planted there (1100) and controlled by the Cinque Ports as a great centre for curing and salting fish for home use and export. Salt fish was a common food in the Catholic Middle Ages.

By 1350 fishing was already the most important east-coast industry—Yarmouth was famous for herrings, Grimsby for cod, and Berwick for salmon. Elizabeth made fish-eating compulsory to help to support the navy. The Reformation had been a great blow to the fishing industry, which in those days was the chief training-ground for the navy. The *Dutch* controlled British fishing from Elizabeth to Napoleon, after that the British, especially the Yarmouth men, gradually recovered it.

Deep-sea fishing needs *rapid transport* at *low temperatures*. The invention of the steam-engine and the steamboat has developed it enormously during the last half-century. They carry both fish and *ice*, which has largely displaced salt and given us fresh instead of salt fish. Hull imports over 30,000 tons of ice from Norway in a year. On board ship, in the market, on the train and in the shop fish is packed in ice. Express trains carry fish from Grimsby and other fish ports, all over England. Formerly fish was often used as manure near the coast, through lack of fast transport. Steam transport, ice, and careful organisation have made the fish trade into a great industry, but there is still great waste through delayed delivery, and unsatisfactory means of transport.

To-day 3,000 large fishing-boats and 7,000 other sea-going boats besides a large number of smaller craft are engaged in fishing, and land in British ports about £30,000,000 worth of fish. In 1920 nearly 15,000,000 cwt. of fish was landed in England and Wales alone, and was sold for nearly £22,000,000. A great array of fishing ports, especially on the east coast, depend on the industry. London, Lowestoft, Yarmouth, Grimsby, Hull, Hartlepool, North Shields, Berwick, Aberdeen, Fleetwood, Milford and Plymouth are among the most important. Their success depends on good railway service and good harbours and docks. (*Cf.* Fig. 103.)

Billingsgate, London, is the greatest fish market in the world, because London is at the head of great railways and sea traffic. The pre-war sales amounted to £4,000,000 a year. In 1920, of 187,000 tons only 14,000 (7·5 per cent.) was seaborne; about 2000 tons were condemned as unfit for food. Increased delivery by rail with increased delay and lack of adequate cold storage causes great waste. It is suggested that a new market be built near to the termini of northern railways and having convenient access. Billingsgate on the riverside is approached by very narrow streets. In 1913 some 222,000 tons of fish were delivered at Billingsgate, of which nearly 62,000 tons was seaborne.

There are various *methods of catching fish*. Near the coast, traps are used for lobsters and crabs, lines for haddock, plaice, dabs and flounders, for codling and whiting. In deeper water, codling, halibut, skate and other large fish are taken with long lines, sometimes three miles long and carrying 5000 hooks. Fish thus caught are fresher and less injured than those taken from trawling nets. Drift nets are used for surface fish—sprats, herrings, mackerel, pilchard; nets are used now even for oysters.

Trawling is the most important method. It was developed by Brixham (Devon) fishermen in sailing trawlers, about a hundred years ago, and spread to Ramsgate, Yarmouth, Grimsby, Hull and Scotland. In the last thirty years steam trawlers have become much used.

They trawl for fish that live on or near the bottom—plaice, cod, haddock, halibut, skate, hake, ling, sole, whiting, etc. The large cone-shaped net is drawn along the bottom for several hours and collects all kinds of things and of fish. Vast numbers of fish, *e.g.* three-fifths of the 500,000,000 plaice annually caught, are crushed and destroyed. This waste is depleting some of the fishing areas.

The enormous annual pre-war catch landed by British boats was in English and other ports estimated at 25,000,000 cwts., worth £15,000,000 (English ports, £10,500,000; Scottish, £4,000,000; Irish less than £500,000). Many foreign boats also discharge in our ports, especially at Aberdeen. The North Sea yields more than half the fish taken, and *the North Sea ports secure four-fifths of the fish landed in England and Wales.* The Dogger Bank, where the sea in places is not more than ten fathoms deep, is the hunting-ground for fish and fishers. Fish flourish there as nowhere else and are captured by millions. The plan of stocking the Dogger Bank with young plaice has met with great success. The fish grow in size and weight two or three times as quickly as on the coast. Grimsby and Yarmouth are near for landing the catch. Thence it is sent to London and all large towns.

Fishing goes on over the shallow seas and the continental shelf around Iceland, Rockall, the Faroe and other islands to a depth of 100, or even in places to 300 fathoms. *The White Sea* has become a most important fishing-ground. The herring is more important than all the other kinds of fish put together. (See Table I.) About 95 per cent. of them come from the North Sea. They abound off North Scotland early in the summer, reach the Tyne later and Yarmouth in September. (*Cf.* map opposite.) The Irish fisheries are much less important than those of England and Scotland.

The freshwater area of England and Wales is about 340 square miles. It is estimated that the annual production of **freshwater fish** is about 2000 tons, chiefly eel, salmon and trout. The supply is largely supplemented by imports chiefly from Holland and Denmark, which send most of the 7000 tons of eels consumed each year. Eels and salmon are migratory fish. *Eels* in autumn bury themselves in the mud, or migrate to the rivers and go down to mid-Atlantic where they breed in large numbers. In spring the young eels (elvers about three inches long) ascend the rivers by millions and thus arrive in all parts of the country.

FIG. 29.—FISHING GROUNDS AND CHIEF FISHING PORTS

They then travel overland to ponds and lakes where they live six, eight or ten years before they go to the ocean to breed. On the Severn is a depot where the elvers are captured and distributed or exported by millions. The pre-war export to Germany was 5,000,000 elvers. It is now controlled by the Ministry of Agriculture and Fisheries.

Salmon go up the river to breed in the autumn and spawn (lay their eggs) in the gravel. Being valuable fish they are carefully protected. The close time for breeding, when salmon may not be taken, covers autumn and winter. They weigh from ten to twenty pounds, but some are much larger. The flesh is fine and much valued. The monks made great use of it and often founded great religious houses near salmon rivers. (*Cf.* Figs. 27 and 47.) British salmon to the value of £1,000,000 a year (chiefly Irish and Scotch) is eaten fresh, but much preserved or tinned salmon is imported. Salmon are taken with net or line. Eels and trout are caught by line, eels also in basket-work pots or traps. The pollution of British, and especially English, rivers has much reduced the abundance of salmon and trout. The supply is partly maintained by artificial breeding.

The Control of Fisheries is more difficult than stock-breeding. Shellfish (*e.g.* oysters, lobsters, crabs, etc.) and river fish suffer from the poisoning of water by sewage and chemicals entering the river or sea. Wasteful fishing—destroying small fish or spawn (fish eggs)—or fishing in the spawning season and the great waste of trawling, does much injury to fish supplies. State control began about thirty years ago, and the inspection of fisheries falls under the *Board of Agriculture and Fisheries* in England and in Ireland. Scotland has a separate Fishery Board. The boards regulate and protect the fisheries. Trawling is not allowed within the three-mile limit. In 1902 an international council was formed to deal with all fishery problems which concern the Western European States.

APPROXIMATE QUANTITIES AND VALUES OF WET FISH AND SHELLFISH LANDED *IN ENGLAND AND WALES* IN 1913 *

TABLE I.—Wet Fish

Chief kinds.	East Coast.		South.		West.	
	1000 cwts.	£1000	1000 cwts.	£1000	1000 cwts.	£1000
Soles and Lemon Soles . .	87	393	11	55	29	180
Turbot and other prime fish .	106	551	14	70	34	207
Cod . . .	2,500	1,580	4	4	141	117
Haddock . .	1,485	1,289	6	5	68	45
Plaice . .	643	937	22	31	35	44
Whiting . .	379	249	16	12	32	20
Herring . .	7,000	2,175	102	39	276	114
Mackerel . .	178	75	117	61	51	31

These with other kinds give the following totals:

	East Coast.	South.	West.
Total weight (cwts.)	13,676,000	523,000	1,950,000
Value . .	£8,076,000	£353,000	£1,580,000

TABLE II.—Shellfish

	1000 fish.	£1000	1000 fish	£1000	1000 fish.	£1000
No. of Crabs . . .	4,470	33	913	27	185	1.75
No. of Lobsters . .	215	10	325	16	64	3
No. of Oysters . .	23,508	83	2,796	5	1,668	3
	1000 cwts.		1000 cwts.		1000 cwts.	
Other Shellfish . .	308	70	15	11	260	61.5
Total value of Shellfish .	£197,000		£61,000		£69,500	
Total values of all fish on each coast . . .	£8,273,624		£413,846		£1,649,419	

1.*The quantities suffered much during the war, but the value was much increased.

2. None of these tables include salmon and other fresh-water fish.

TABLE III

Fish landed in the United Kingdom in 1913 by British boats

	Wet Fish.		Shellfish.
	1000 cwts.	£1000	£1000
England and Wales .	16,152	10,009	327
Scotland . . .	7,259	3,723	71
Ireland . . .	894	307	27
Totals in full . .	24,305,000	£14,039,000	£425,000

1. The quantities dropped in 1915 to about one-third and the value to about two-thirds. In 1920 the 1913 quantity was almost reached and the value was doubled.

2. Much foreign-taken fish is landed in British ports, and in addition we import about 2½ million cwts. of fresh fish and about 1½ million cwts. of canned and cured fish. We export nearly half the total landings, *i.e.*, about 1½ million cwts. of fresh fish and 9½ million cwts. of cured or salted fish—herring, cod, mackerel, pilchard and haddock. Some of this is, however, first imported.

The value of fish imported and landed by foreign fishing boats in 1913 was nearly £5,000,000.

The exports, chiefly salted and cured, were worth about £15,000,000, of which nearly half was herring.

EXERCISES

1. Find the total weight and value of the chief kinds of fish landed in England and Wales (Table I).

2. Construct a table arranging the fish in order of value of the year's landings, and showing the total value (Table I).

3. Make a list of the chief fish in order of their value per cwt. or per ton (Table I).

4. The quantities are sometimes given in tons. Write out in full the quantities in Table III. Express them also in tons. Find the average value of wet fish per ton (Table I).

5. Explain why the export value is so much greater than the value of the fish taken.

CHAPTER X

COMMUNICATIONS: ROADS

Communication means sharing. Man has progressed, civilisation has advanced by men sharing their goods, their thoughts, ideas and feelings. In olden times it was very difficult to travel or to send goods. The means of communication—roads and rivers—were few and bad. Travel cost much time and money and was dangerous. Trade was undeveloped because people could not meet to buy and sell and goods could not be moved. People rarely left their town or village, they knew little of outsiders, whom they disliked and mistrusted.

Mediæval market-towns treated English and foreign strangers alike—*i.e.* as foreigners and outsiders, subject to the same restrictions of trade. In Elizabeth's time most villages were self-sufficient, to-day they draw on the resources of the whole world. Many families have occupied the same house for generations, to-day the sons and daughters scatter over the world. They still produce in distant lands the food for the British tables. To-day people can go anywhere, or communicate without meeting. Their thoughts and wishes can be sent quickly and cheaply. The Post Office is organised to carry letters, newspapers and parcels, to telegraph and telephone messages all over the world. In the nineteenth century Britain's industrial development gained fifty years' start on the world by the invention of railways and steamboats, and the start has not yet been entirely lost.

The war taught us the supreme importance of transport. Men, munitions, food, clothing, are worse than useless unless they can be placed quickly and with certainty where they are needed. In peace also, every great development, all material progress waits for transport. Coal is useless at the pit's mouth, no factory can flourish unless it can cheaply distribute its goods over the world. Communication is essential to trade and commerce, and is one of the first conditions of any successful enterprise. It is now carried on by river and canal, by road and railway, by sea and ocean, by airship and plane, by wire and wireless. Each year time and distance become less serious obstacles to travel, to transport, and to communication.

Roads

The Ancient Britons had their foot-ways and cattle-tracks on the ridges, especially on the downs, which were largely treeless and therefore safer. The Pilgrim's Way [1] (Winchester to Canterbury) may be one of these. They made causeways, fords, and chariot-ways in some of the river valleys, *e.g.* at St. Albans. These early beginnings fixed the sites for many later villages, towns and roads. They were used by conquering people as the ground-work of their settlements.

The Romans opened up Britain by means of their strong, indestructible roads which still form the skeleton of our road system. (*Cf.* map opposite.) Intended chiefly for foot traffic—horse and man—they were straight and direct and ran over hill and dale, over Downs and Pennines. When wheeled vehicles and heavy goods became common the gradient became more important than the distance. Many of these roads fell into disuse and now serve as bridle-ways and footpaths—shown by dotted lines. Others, as Watling Street, are still among the most important roads.

The Saxons used the Roman roads as a means of conquest, pushing along them and over the fords into the heart of the country. But they settled in clearings away from the roads for greater safety. Their footpaths and horse-tracks between

[1] Read Belloc's *The Old Road* and *Stane Street*.

villages went round fields and woods and developed into our system of winding country lanes.[1] Their towns grew up frequently at river crossings, so that *ford* towns (such as Bedford)

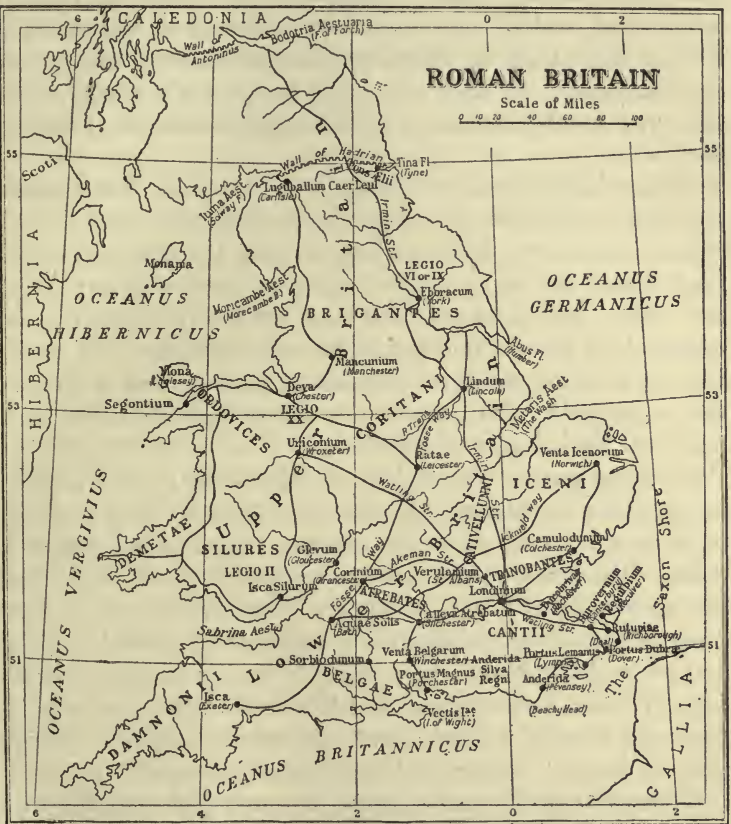

FIG. 30.—SOME ROMAN TOWNS AND ROADS

greatly outnumber *street* (*i.e.* road) towns, *e.g.* Street, Stretham,[2] Stratford, Streatham.[3]

The great Roman roads were given Saxon names, but the

[1] *Cf.* map, p. 186. [2] Near Ely. [3] S. London.

Roman skill in road-making was lost. Market towns slowly grew up, intercourse between villages and towns increased, and roads or rather road clearings were made and maintained by those who needed them. Monasteries as homes of religion, culture and wealth became centres of intercourse and of roads. Bridges were built by religious and philanthropic people and by monasteries. To build or repair a bridge was a worthy action approved by the church; as pilgrimages developed it became more so.

During the Midde Ages the roads were very bad. *The Normans* travelled much from one estate to another with servants and furniture, and they did something to keep the tracks in repair. Each manor and each town had to repair its own roads; labour was cheap, but good material was not always to hand, and road-making was not understood for many centuries. To protect travellers against robbers, landowners had to clear a hundred feet on each side of the chief roads People rode on horseback; ladies sat behind men on pillions.

Land enclosure, the decline of agriculture, the dearth of labour (after the plague), the leasing of land by lords and their consequent absence from the manors, caused great **neglect of roads.** The common duty was nobody's business. Agriculture therefore suffered heavily, little trade or exchange of products was possible. Even the physical development of animals suffered. Long-legged cattle and sheep were the favoured type. To-day, legs are short, bodies large. *The Reformation* destroyed pilgrimages and affected pilgrim ways. It was no longer a religious duty to keep up bridges and they fell out of repair.

Under Elizabeth coaches came into use, but even the royal coach was frequently overturned in the ruts or stuck in the mud. From 1530, Acts were passed compelling the **people of each parish** to repair bridges and roads, but with little effect. Stage wagons, however, began to run between the principal towns, private carriages increased and better roads became a necessity.

In 1645 stage coaches were in use and travel became more common. To assist the parishes, turnpike trusts were set up, first on the Great North Road (1663). Road-making ceased to be voluntary. It seemed fair that all users should help to repair the roads. Tolls were collected at frequent toll-bars. There was, however, much opposition and many toll-bars were destroyed. Severe laws were passed and in time England was covered with turnpikes, *i.e.* tollgates.

Yet roads improved little. Most people rode, carriages could be used only in summer and then only with great risk. There were no guide-posts, carriages had no springs, passengers were heavily armed against highwaymen. The average coach rate was six miles per hour. In 1750 Devon had not a single wheeled carriage. There was one stage coach a month between London and Edinburgh—it took twelve to fourteen days. After 1760 things began to improve. Rates were levied to buy materials, but there were many difficulties. Landlords opposed roads as later they did railroads. No one knew how they should be made. Pedlars were still the chief merchants and means of communication in the country. Villages knew little of each other or the world. They were still self-sufficing and had little outlet or inlet for trade, want of roads prevented development. Pack horses carried goods at enormous cost. In winter coal was taken to Manchester in panniers, a horse carried 280 lbs. Goods were carried between Liverpool and Manchester at the rate of forty shillings per ton.

In Ireland and Scotland things were better. The Irish county authorities took charge of the roads (1765). In Scotland parliament appointed road commissioners (1803) to make new roads. Telford built 900 miles of Highland roads, the government paid half the cost. *Telford* and *MacAdam* were rival roadmakers. In 1827 MacAdam was made Surveyor-General in Great Britain. From that time we have had macadamised roads—made of broken stone which binds well together. The Turnpike Trust still supplied much of the money for high roads, but not nearly enough. In 1864 the Trust was abolished and the roads were again maintained by the parishes by means of a highway rate. The burden was far too heavy and in 1888 the *county authorities* were given charge of bridges and main roads, while *local councils* (Borough, Urban, Rural and Parish) maintain other roads. In 1909 a Road Board and a Road Fund (raised by a duty on motor spirit and by carriage licences) were established to develop and maintain highways and bridges. The annual expenditure by local authorities on roads since 1910 has averaged nearly £20,000,000 (England and Wales about £17,000,000, Scotland nearly £1,500,000, Ireland nearly £1,250,000). In 1919 the government set up a fund of £10,500,000 for making and repairing roads and bridges, and proposed to raise £7,000,000 in 1920 by motor taxes alone. The English roads are now to be classified according to their importance for through traffic as: (1) First-class; (2) Second-class; (3) Other roads.

Road-making is an important branch of engineering. Care is taken to make new roads wide, straight, and well drained. To avoid steep inclines hollows are filled, cuttings made, and sometimes winding roads are built. Motor roads are now carried over mountain passes as at Shap and Plinlimmon. Narrow streets in old towns are widened, often at great expense, when houses and shops are pulled down and set back. It has even been suggested that roads should supersede railways, and our main lines become trunk roads for fast and long-distance motors.

The introduction of *motor traffic* on the roads has created a new and great demand for good roads. Motor travel and transport is cheap and fast, convenient and direct. It saves the labour and risk of repeated loading. Hence the use of roads has much increased. It is estimated that there are 750,000 engine-driven vehicles on the roads. But heavier and faster motors destroy the surface much more. New methods of paving are used—in towns stone setts, wood paving on cement, and asphalt (the two latter for quietness). In the country some kind of tarred surface is now common. All these produce dry and dust-free roads which last much longer and are more convenient.

A great system of motor transport is rapidly developing as alternative and supplementary to the railway. Every large town has its motor-buses and is a centre for routes radiating into the country. Remembering that the large towns are seldom more than twenty miles apart, we see that bus, motor-coach and charabanc can easily weave a great web of motor traffic. A road guide has been prepared to give the details for arranging motor journeys, and a central motor station for London has been established with booking offices. Daily services are run and return tickets cost little more than railway fares. Similarly the organisation of motor-lorry depots in the towns will ensure prompt and cheap transport of goods by road.

Road traffic is likely to increase as roads improve. Roads are national property (railways and canals are private). Much attention is being given to road-making, and new trunk roads are projected, *e.g.* the new Great West or Brentford Loop Road from London to the Bath Road, Hounslow; the Croydon by-pass, and other main roads leading out of London. Thus London and other large towns are improving their main approaches with the help of grants from the Road Improvement Fund. The best-known roads from London are: The Great North Road, London to Edinburgh; Watling Street, Dover to Shrewsbury and Chester; the Bath Road; the Ripley Road, London to Guildford and Portsmouth; and the Brighton Road. The road map should be carefully compared with the canal and railway maps.

MILEAGE OF BRITISH ROADS, CANALS, RAILWAYS AND TRAMWAYS

	Roads.	Canals.	Railways.	Tramways.
England .	150,000	3,640	17,000	3,000
Scotland .	26,000	185	4,000	
Ireland . .	60,000	850	3,200	
Total . .	236,000	4,675	24,200	3,000

QUESTIONS

1. Compare the Roman and Saxon roads and account for the differences in number and character. (*Cf.* maps, pp. 109 and 186.)

2. What do we learn about English roads from Chaucer's *Canterbury Tales*?

3. Explain the great development of road traffic in the eighteenth century, its decline in the nineteenth, and the great revival in the twentieth.

4. Why does the Treasury now heavily subsidise the County Council's road making and mending, and how does it raise the money for this?

5. What is the purpose of the new "bypass" London roads under construction? Show how the traffic on the main roads radiating from London will be relieved in London itself by the projected south and north circular roads to be built largely outside London.

CHAPTER XI

INLAND WATERWAYS

River transport is a natural and cheap means, but slow. The British Isles are well supplied with rivers. On the west many are short, swift, small and shallow: some suffer from rapids, falls, sandbanks or bars. But some on the west and south, and still more on the east, are much used for traffic on their lower courses, and all our large ports stand on river mouths. The British climate, with its well distributed rainfall and temperate winters, favours water transport. Yet few British rivers carry vessels other than barges on their middle course. Many rivers have been canalised for barges, but railways have stopped much river and canal traffic. The future may see them much more used again. A horse will haul forty tons on a canal as against one ton on a level road, and at the same speed.

The *Romans* made the first British canals in the Fens. The Caer Dyke (40 miles long) from Peterborough to the Trent is now scarcely traceable, but the Foss Dyke (10½ miles, Torksey-on-Trent to Lincoln) is still navigable.

The Saxons and Danes made the rivers the chief routes of their conquest and settlement. The Thames was for long closed against the Saxons by the fort of London, but other rivers were less well defended and carried the invaders into the heart of the country. The rivers made advance safe; the way could not be lost, sudden attack was impossible, return was easy. Their earliest settlements were made alongside or near rivers. (*Cf.* map, p. 186.)

The *Normans* did little for river or sea traffic, but foreign merchants, "Easterlings" (Germans), settled in London (A.D. 979), and controlled its trade and that of Lynn for centuries. Southampton grew through Italian merchants. Foreign merchants carried on much of the English trade and little was done to improve the rivers. Their ships were small and the high tides helped them over many difficulties. Most large towns and especially ports owe their earlier development to means of inland communication, and often became centres of a road-river-canal system and later of railways and external communication (shipping)—*e.g.* London, Hull, Bristol.

Tidal rivers were particularly important in the founding and development of large towns. Many inland river ports, *e.g.* Chester, York, Ely, Ipswich, Canterbury, developed through the use of the tidal river by the shallow boats of the Danes and early English. Other towns were established at points where navigation ended (often at a ford or bridge), as Doncaster, Cambridge, Norwich, Welshpool, Bristol (Bridgestow, bridge-place). Similarly, but often later, many towns at the mouths of rivers have developed through coastal and oversea trade into large and important ports. London, Lynn, Hull, are early examples; modern river ports on east and west are very numerous from the Forth to the Clyde. Some ports have risen, as others fell starved by the silting up of rivers and estuaries. Rye, Winchelsea, Winchester, Poole and Chester have lost their shipping and trade to Folkestone and Dover, to Southampton, Weymouth and Liverpool. (*Cf.* map, p. 147.)

In many cases the port used the river as an important means of internal communication. But such difficulties as droughts, floods, swift currents, shallows, mud banks or, in flat districts, very winding rivers made river control necessary. Therefore most rivers could not be well used and, except on quite level ground which is rare, canals could not be made until **locks,** to control the water and maintain depth, were invented at the end of the fifteenth century. After this some European nations rapidly made canals, especially those having large, level tracts crossed by wide, deep, slow rivers. In England there are many

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FIG. 31.—NAVIGABLE WATERWAYS

ridges of hills, and in following a contour-level the course is often carried along a very winding route. England started late in the seventeenth century by canalising the Wey, *i.e.* deepening, straightening and controlling the river by means of locks and short lengths of canal. Such a waterway is called a *Navigation.* In 1699 the Aire and Calder Canal (Navigation) was made, to join Leeds to Hull.

The canalising of rivers went on very slowly, and most of the great waterways were of little use. Few had continuous towing-paths. Even the Thames water was not controlled till after 1805. This delay increased the demand for canals; rivers were often made mere feeders of canals, instead of being canalised.

The development of mines and manufactures and the growing demand for coal increased the need for cheap transport. Industry and trade in the nineteenth century were crippled by the difficulty and cost of carriage. Cartage by road, even a few miles, doubled the price of coal. Pack horses carried coal from Worsley to Manchester at six shillings to eight shillings per ton. The famous Bridgewater Canal was made by Brindley (1759–61) to overcome this difficulty. It joined the Duke of Bridgewater's collieries to Manchester (10¼ miles) and reduced the carriage of coal to two shillings and sixpence per ton. It was much used for passengers. Special boats with seats, shelter and refreshments ran regularly. The canal was soon extended twenty-four miles to Runcorn on the Mersey, joining Liverpool and Manchester. The Grand Trunk was next built from Runcorn through the Potteries to the Trent (139 miles). It was meant to be a trunk canal whose branches would link up the Midland rivers. Wedgwood, the potter, was foremost in this. It was very useful to the pottery trade.

The strong objection raised in the eighteenth century against all inventions tending to quicken and cheapen processes was raised against canals. They would use up valuable land and much money. They would ruin the existing carriers (by road and by sea). They would thus both lessen horse-breeding and injure the navy. It was even urged that canals should not be brought nearer to towns and villages than four miles, so that carriers should continue to be fully employed. Similar arguments were later directed against the railways which killed canals. The actual result was just the opposite. Canals increased road and sea traffic, and to-day both depend almost entirely on railways.

But Brindley, the great canal engineer, planned other canals. His example was quickly followed. There was a canal mania. People readily lent money to canal companies. Brindley's navigators became "navvies," a new type of workman. By 1834 (*i.e.* in seventy-five years) the great collieries, manufacturing centres and seaports were linked together by canals and navigable rivers. The largest canals are the Grand Canal, nearly 240 miles (Dublin to the Shannon), Shropshire Union 200 miles, Grand Junction 190 miles (Brentford to Braunston, with branches to Aylesbury and Northampton), Birmingham 160 miles, Leeds and Liverpool 145 miles. (*Cf.* Canal Map, p. 117.)

Birmingham and the Black Country became the centre of a great canal system as London is of the road and railway systems. Canals assisted mineral and manufacturing developments. Coal, iron, stone, lime, salt, wheat and timber and pottery were carried and road traffic was much eased. While canals were so flourishing the companies made roads and railroads on which wagons were drawn by horses to the wharves and docks. This prepared for the construction of railways and thus in the end to the destruction of canal traffic.

Canal traffic, though cheaper for heavy, bulky, and fragile goods in large quantities, could not compete with railways for passenger traffic, or even prompt or convenient carriage of goods. Moreover they differ greatly in width and depth so that boats often cannot pass over different canals. The canal companies failed to co-operate and fit the canals for full and convenient use as a means of through communication.

Stephenson killed the canals by inventing the locomotive, and building the Manchester and Liverpool Railway. Public interest and money were rapidly transferred to railways, which were

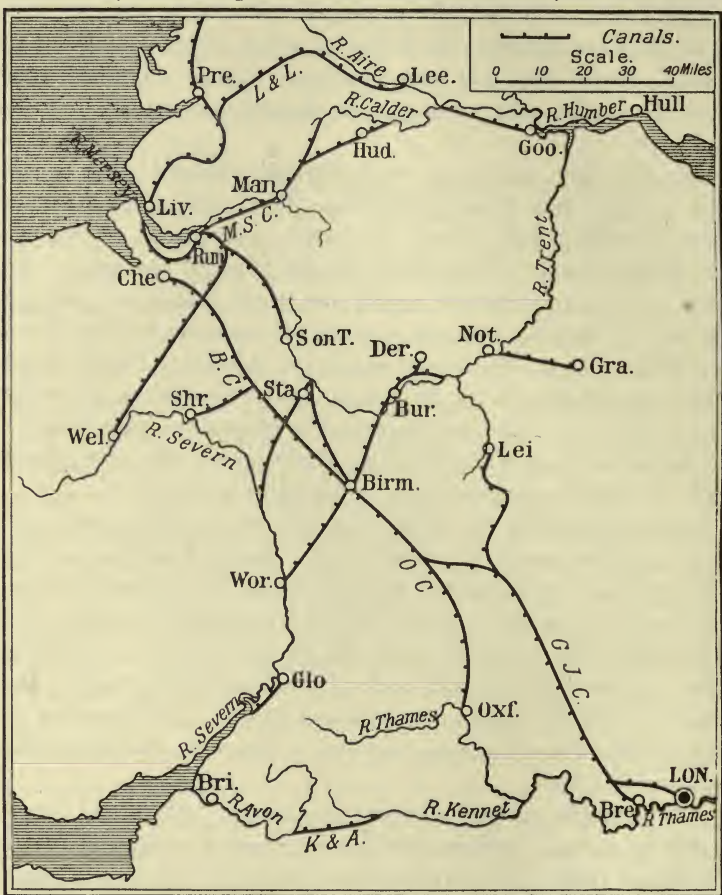

FIG. 32.—THE CHIEF ENGLISH CANALS AND CANALISED RIVERS, SHOWING THE "CROSS" AT BIRMINGHAM

more easily built, and which provided for through traffic. The canals were soon crippled and many were then bought up cheaply by the railways, and closed or starved. Sometimes a railway bought one canal in a system and so broke the continuity. A few canals were converted into railways.

In the busier districts some canals still prosper. They should be traced on the map. The Aire and Calder Navigation (traffic 3,000,000 tons per annum) carries great quantities of coal and has been steadily enlarged and improved. The Weaver prospers on salt transport. The Leeds and Liverpool, Bridgewater and Grand Junction Canals, and the Trent and Mersey and the Don Navigations still pay well. They serve busy manufacturing districts, and the Grand Junction connects the Midlands with London. The Birmingham district canals carry about 7,000,000 tons per annum. The southern canals are derelict, or nearly so. They are now interesting for their beauty and their fishing. The upkeep of traffic conditions on rivers and canals is costly, and has recently enormously increased. The tendency to fall out of use is thereby greatly increased. Many smaller rivers, *e.g.* the Medway, navigable to Tonbridge, are now threatened. Only some joint action of the whole area affected can save them.

To-day Birmingham has four canal routes to the sea (see map opposite):

(1) *via* four differently owned canals to Brentford and London (greatest load that can pass, 30 tons).
(2) *via* four canals to the Humber (20 tons)
(3) *via* three canals to the Mersey (20 tons).
(4) *via* canal to Worcester (30 tons) and thence by the Severn and the Berkeley Canal to the Bristol Channel.

Improvement is only possible by amalgamating the canal companies on each route and reconstructing the canals.

Compared with England, Scotland has less need for and is physically less suitable for canals, except in the Forth-Clyde Valley. (*Cf.* map, p. 123.) Ireland is physically suitable but has less need through lack of minerals and industrial traffic. (*Cf.* map, p. 341.)

A Royal Commission on Inland Navigation reported in 1911. They found that different sections of through canals are under different control and are often of different depths and width of locks so that boats cannot run through. There are *four* different gauges from London to Liverpool. Traffic is hindered and rates are high; few canals pay dividends, and few are kept in order. They recommend that the canal system be bought by the State or placed under a central control, and that the waterways be improved and made uniform. This would cost several million pounds and would include reconstructing the "Cross"—four main routes from the Birmingham centre to London, Liverpool, Hull and Gloucester—to carry barges up to 100 tons.

Ship Canals are made (1) to shorten important sea routes, as the Caledonian and Crinan Canals; (2) to avoid river difficulties, as the short canal to Exeter, and the Berkeley Canal (16½ miles) to Gloucester; (3) to avoid unshipping goods, heavy dock duties and railway charges in conveying goods to a large inland port, as the *Manchester Canal*. This canal connects Manchester and Liverpool. It utilises the rivers Weaver and Mersey and is 35½ miles long, 28 feet deep and 172 feet wide. It is crossed by many roads and railway bridges, and by a swing aqueduct which carries over it the Bridgewater Canal. It cost originally £15,500,000. Money is still being spent on it and the docks at Manchester. In 1913 it carried nearly 6,000,000 tons and its traffic earnings were over £650,000. In 1919 the tonnage was 3,500,000 tons and the value of the sea-borne trade nearly £150,000,000. (*Cf.* map, p. 299.)

The Gloucester and Berkeley Ship Canal avoids the very winding Lower Severn channel (26 miles), and the dangerous tidal currents. It was built in 1827 and cost £500,000, is 16½ miles long, is on one level and has a lock at each end. It was 18 feet deep but is now only 15 feet, and carries vessels up to 600 tons to Gloucester. Those of 300 tons can get up to Worcester, only 30 miles from Birmingham. There is now considerable traffic on the canal, which would be much increased if the canal to Birmingham were enlarged to carry ships of 300 tons or more. It has been suggested to improve the canal to Sheffield to a similar size.

The Caledonian Canal, built 1804–23 by the Government, saves the stormy passage around Scotland and enables small

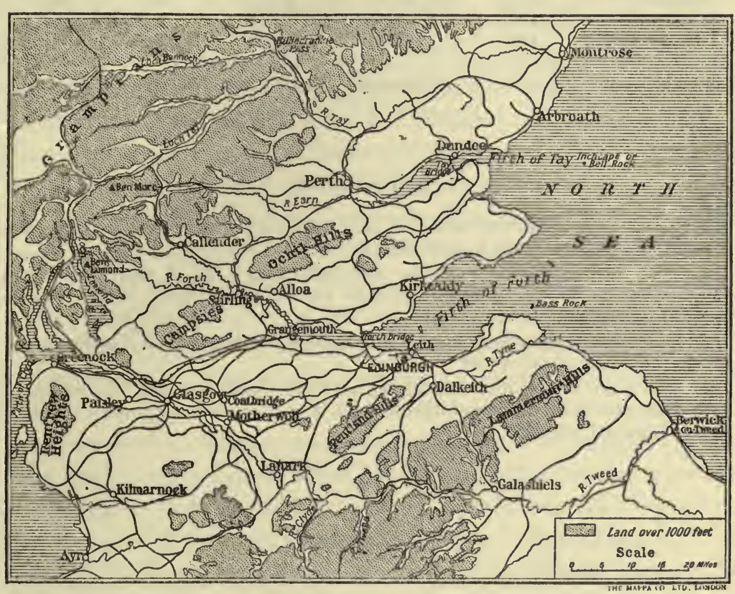

FIG. 33.—SCOTTISH RIFT VALLEY: RIVERS, CANALS AND RAILWAYS IN RELATION TO RELIEF

warships to pass rapidly from the east to the west coast of Scotland. It is 60½ miles long, but only 22 miles is canal. It cost about £1,000,000, but in the middle it was not built so wide and deep as originally designed. The traffic on it is small—chiefly tourist steamers and fishing boats. The Crinan shortens the steamship route from Oban to Glasgow.

Other ship canals have been suggested, viz.: Tyne to Solway, Forth to Clyde, Birmingham to the sea.

TABLE OF CANALS AND RIVER NAVIGATIONS

	Working Canals.	Traffic.	Receipts.	Canals.	
				Derelict.	Converted to Railways.
	miles.	1000 tons.	£1000	miles.	miles.
England .	3,425	42,000	2,500	400	83
Scotland .	185	1,180	60	60	—
Ireland .	850	800	120	62	—
Totals .	4,460	43,980,000	£2,680,000	522+83=605	

QUESTIONS

1. Make a comparative table of the advantages and disadvantages of Roads, Canals, Railways, and Air Routes.

2. Why are British Canals so unsatisfactory? Is it worth spending £10,000,000 to make them an efficient transport service? How does the motor lorry affect the question?

3. Distinguish between canals and canalised rivers. How do the former obtain and lose their water?

4. Trace on a map the inland water route from London to Liverpool, and show the chief towns connected by it. (Canals are shown on several of the regional maps.)

CHAPTER XII

RAILWAYS

Railways, like canals, began in districts of rapidly growing trade and industries. In time the Bridgewater Canal failed to carry the produce of Manchester quickly and cheaply to the sea. It became blocked with goods, and charges were very high. The proposal to build a railway between Manchester and Liverpool was strongly supported. The railway was opened in 1830 and the canal at once began to decline.

Railways had long been developing. The two problems—a better road and a better horse—were gradually being solved. In the fifteenth century some collieries made smooth and level tracks by pegging wooden rails to sleepers. In the eighteenth, iron plates with flanges were used to keep the wagons on the rails and prevent wear. These hindered traffic crossing the rails. The flanges were then made on the wheels and flat "plates" were "laid" on the wooden rails. (Hence "platelayer.")

The Steam-engine was also being gradually improved. Stationary engines were common after Watt's inventions. In 1801 a Cornishman built an engine to run on the road. Hedley's "Puffing Billy," 1813, and Stephenson's "Rocket," 1829, overcame the difficulty of the steam horse. After many years work both engines were placed in the South Kensington Museum where they may still be seen. The first railway to carry passengers was the Stockton and Darlington line, opened in 1825 by Stephenson. A speed of twelve miles an hour was reached in parts by a train of coal and passenger waggons. Stephenson next built the Liverpool and Manchester Railway on which the "Rocket" drew a thirteen-ton train at fifteen miles per hour. Railways met with all the objections offered to canals—and more. Canals and carriers would be ruined, land and crops spoiled, cattle and horses frightened or killed. But railways developed rapidly. In 1838 the London to Birmingham Railway was opened. Railway mania (1845), speculation and panic followed, but railways steadily increased. In 1850 there were 6621 miles of railway with a capital of £240,000,000. To-day there are about 24,000 miles (equivalent to 55,000 miles of single track) in the United Kingdom, and a capital of £1,350,000,000.

The traffic of both road and canal was much affected by railway building. Passengers travelled by road (for speed), goods by both. There were twenty coaches running between Liverpool and Manchester daily and sometimes extra coaches. The railway doubled the number of passengers in eighteen months, carrying on an average over 1000 a day, the fare fell from ten shillings to five shillings, and the time from four hours to 1¾ hours. Goods were carried at about two-thirds the rate in two hours instead of twenty hours. The lists of goods and rates of carriage on canals became the basis of charges on the railway.

At first the lines were local railways, built to carry goods in industrial or mining districts, and there was again the danger of a multitude of companies, but gradually big companies were formed which joined up local lines and extended them to London and other large towns, *e.g.* the Great Western Railway absorbed the Bristol and Exeter and the South Devon and Cornwall Railways. The Great Central quite recently carried its main line to London. In 1921 the London and North-Western Railway purchased the Lancashire and Yorkshire Railway. This joint railway is second only to the Great Western Railway in length and has an authorised capital of over £210,000,000. There are still, however, about 120 railway companies in the British Isles. Railroad building and the fixing of fares and rates for goods were controlled by Parliament and the Board of Trade. Each company was given its own area to develop. This prevented undue competition and also neglect of less populous districts.

Railways, like canals, suffered from the short-sighted policy which built them for local use and did not standardise the tracks or rolling stock. The railways were a natural development of road traffic and were intended for the use of coaches and wagons used on the roads. Hence the common gauge is still 4 ft. 8½ in., as introduced by Stephenson. The companies built the lines, traders used their own rolling stock. Railway wagons are still largely private property (chiefly of coal-owners) and are not standardised except as to wheel gauge. There are about 1,500,000 in use of various sizes and designs. A standard wagon of thirty tons would save nearly 100 per cent. in running costs, and much congestion and labour. The English railways (except short narrow-gauge lines) have now the same gauge, 4 ft. 8½ in., but for many years the Great Western kept its more comfortable and perhaps safer gauge of 7 ft., introduced by the engineer Brunel. The English invented railways, but they were soon adopted in Europe and America, and English engineers and methods were largely employed. Hence, except in Russia and Spain, the standard English gauge is used. This was of the utmost importance during the war and after. Russia adopted a different gauge as a measure of defence.

The war made complete *Government control* of the railways necessary. This opened a new era in railway organisations. They were used as one system, and many changes were made by the new Ministry of Transport which took control. Before giving up control in 1921, a railway bill was introduced which, as from 1923, provided for (1) the economical grouping of railways, the southern, the western, the midland and the north-western, and the north and north-eastern railways in four great systems; (2) a simpler classification of goods carried; and (3) a Railway Rates Tribunal—a permanent court of three—to fix railway charges. For the regulation of wages there will be Whitley Councils for each railway, a Central Wages Board, and a National Wages Board to hear appeals. The public is protected both as to reasonable convenience and service (including standardisation) and as to charges. The state regulation of the railways will be exercised through the Railway and Canal Commission and the Board of Trade. Irish railways will be dealt with by the Irish Parliament.

London has become the centre of the railway system. Its size and wealth and intercourse, its position as capital of the United Kingdom and British Empire made this necessary, but, apart from Greater London, railways have been most vigorously developed in the great industrial districts of Yorks, Lancs, South Staffs, South Wales and the Clyde Valley (see maps, pp. 123, 279, 284, and 297).

In 1896 an Act was passed to permit and control the construction of *light railways* (*e.g.* tramways) on public roads or private land. Light railways have the standard, or a smaller, gauge, but are intended for simpler, slower traffic and lighter loads. In mining and some agricultural districts they are very useful. In towns systems of tramways have been constructed. Previously the *speed limit* for engines on the high road was five miles per hour. A man carrying a red flag went before the engine. After 1896 the limit was raised to twenty miles per hour and motor traction became common.

Electric tramcars and motor buses have greatly increased the convenience and speed of travel while decreasing the expense. In 1914 there were 2703 miles of electric tramways and light railways, and over 3,426,000,000 passengers were carried in the year. In London a great system of *underground electric railways* (" tubes," metropolitan and district) has been developed, which is combined with the London General Omnibuses. Together they carry quickly and comfortably some 1,200,000,000 passengers a year, and receive for fares £12,000,000 a year. These railways link up all the great railway termini of London (see map, p. 225). Before the war the work of electrifying and connecting suburban lines had made great progress. Further extensions of this work are now projected (1922), and services will be greatly accelerated and cheapened within a radius of fifty miles.

Railway routes are determined by their commercial uses and by physical difficulties. The railway was evolved in the transport of goods, especially of coal. Since the opening of the first public railway—Liverpool to Manchester, 1830—when the trucks were promptly crowded with people—the carrying of passengers has been at least as important as the goods traffic. Thus, while the early railways were local lines for developing coal-fields and industries, they have become great transport systems connecting producers and consumers. They reach out to the great towns and finally to London; they terminate in one or more ports, to and from which they carry passengers and goods.

The prejudices against railways kept main lines from entering some residential towns, *e.g.* Windsor and Oxford, and physical difficulties have greatly influenced their routes. High ground and wide estuaries are obstacles to railway-building. The experience of canal and road engineers was of great value in making tunnels, cuttings, and bridges. A careful study of the map shows, however, that great care was taken to avoid initial cost in railway-building, and working cost in running trains over heavy gradients. The main lines out of London follow the river valleys, using river and wind gaps to cross the Chilterns and Downs. (*Cf.* map, p. 225.) The Midland (twice), the Lancashire and Yorkshire and the North British cross the Pennines in the same way. (*Cf.* map, p. 295.)

In Wales and Scotland the control of railways by mountains and river valleys is still more marked. In North and South Wales, Westmorland, and east and west of the Cotswolds use is made of a narrow coastal plain to avoid crossing the high land. Similarly, long and deep estuaries are circled. Study the map of the Thames, Humber, Forth, Tay, Moray and Dornoch Firths, Clyde, Mersey. Note the ferries on all these estuaries. The Forth ($1\frac{1}{2}$ miles) and Tay are bridged; the Mersey and Severn ($4\frac{3}{4}$ miles) have railway tunnels. The Thames has its Blackwall Tunnel for road traffic, and a Tilbury-Gravesend tunnel is suggested.

Railways cannot always conveniently get round mountains. Long gradients or tunnels are often preferred. The London and North-Western Railway passes through the Kilsby Tunnel (nearly 2500 yards) near Rugby, and over Shap Fell (nearly 1000 feet high) in Cumberland. The Lancashire and Yorkshire Railway has a most difficult route with many tunnels, ten of which range from nearly 1000 yards to 2500 yards in length. A branch of the Midland connecting Sheffield and Stockport passes through the Peak district by many tunnels, one of which is over $3\frac{3}{4}$ miles long.

Railways were much feared at first, but their advantage to trade and civilisation has been enormous. Traffic and travel became much cheaper, easier and quicker. Business of all kinds developed rapidly and many perishable products, as fish, fruit, milk, are now profitably conveyed long distances to good markets. Thus both producers and consumers are greatly benefited.

Cheap and convenient travel enables the peoples of the world to mix freely together. This intercourse furthers commerce and enterprise, national development and peace, the spread of knowledge and civilisation generally.

Some English towns and districts have profited enormously by railways, others comparatively little. To-day the poor are free to seek new homes and better work. The demand for labour in industrial towns has helped to draw people from the country and crowd them into towns. But local facilities for transport—tubes, trams and buses—encourage even the poor to leave the overcrowded town for the outlying districts, while the middle and upper classes with the help of motor cars and express trains can live far away from their daily work. Many London workers have their homes on the east and south coasts and in the country within a radius of a hundred miles of the city. The conditions of life and work have been revolutionised by better means of communication. Make a careful study and analysis of each railway system (*cf.* Table III.), using the physical map to show which physical conditions helped or hindered the

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FIG. 34.—THE MAIN RAILWAYS OF GREAT BRITAIN AND IRELAND

building, and the economic map to show the industrial conditions which demanded the railway and resulted from its existence. (N.B.—The regional maps, *e.g.* pp. 272, 279, 317, 331 and 334, give very good details of railways in relation to relief.)

TABLE I.—British Railways (1912)

	Miles of:			Cost per mile.	Total Capital.	Yearly Earnings.
	Railway.	Track.	Sidings.			
				£	£	£
England & Wales	17,000	30,000	14,000	36,000	1,103,000,000	110,000,000
Scotland	4,000	7,600		33,000	186,000,000	13,500,000
Ireland	3,200	3,400		11,000	45,000,000	4,500,000
Totals	24,200	41,000	14,000	—	1,334,000,000	128,000,000

The United Kingdom has less railway mileage than that of some larger countries. But for its size it stands second only to Belgium, which has more than 40 miles to 100 square miles. The British Isles have about 20 miles; England alone nearly 28 miles. Within a radius of about 30 miles the London area averages over 40 miles, and a part of South Wales over 50 miles per 100 square miles. While many foreign railways are single tracks, English and Scotch Railways are largely double tracks (or more). The average cost per mile of track was much higher than that of foreign railways. The traffic, however, is much greater—average about fifty trains per day (pre-war), France 25, U.S.A. 20. In the busy morning and evening hours London tubes run trains every two to three minutes.

TABLE II.—Railway Traffic and Receipts, 1912 and 1920

	Passengers	Season Tickets.	Goods and Minerals Carried.	Total Receipts.	Expenditure.
	1000 pass.	1000	1000 tons.	£1000	£1000
1912 . .	1,300,000	780	520,000	128,250	81,250
1920 . .	1,567,000	1,015	310,900	302,100	250,800

TABLE III.—ANALYSIS OF THREE TYPICAL RAILWAYS

Main Railways.	Chief Branches.	Carrying.	Inland Towns.	Ports Served.
G.E.R. London to Yarmouth Stratford, E.[1]	1. Yarmouth *via* Ely 2. Yarmouth *via* Ipswich	Fish, fruit, corn, mustard, potatoes, dairy produce, agricultural machinery, timber	1. Cambs, Ely, Norwich 2. Colchester, Ipswich	1. Yarmouth, Lynn 2. Harwich, Lowestoft
G.W.R. London to Bristol *via* Reading and Bath Swindon[1]	1. Bristol to Penzance 2. Bristol to Pembroke 3. Swindon to Mid-Wales 4. Didcot to Birkenhead	Agricultural and dairy produce, fruit, coal, iron goods, tin plate, manufactured goods. Irish and American mails and passengers	1. Taunton, Exeter 2. Carmarthen 3. Gloucester, Hereford, Builth 4. Oxford, Birmingham, Shrewsbury, Chester	1. Bristol, Avonmouth, Plymouth, Falmouth 2. Newport, Cardiff, Swansea, Milford, Fishguard 4. Birkenhead
M.R. London to Derby, *via* Bedford and Leicester Derby[1]	1. Derby to Carlisle 2. Derby to Manchester 3. Derby to Bristol and Bath 4. Derby to Lincoln 5. London to Shoeburyness	Coal, cottons and woollens, boots, hosiery, laces, cutlery, hardware, earthenware, agricultural and dairy produce, cattle Daily supplies, visitors, vegetables, coal, oversea passengers and goods	1. Sheffield, Leeds, Appleby 2. Stockport 3. Birmingham, Cheltenham, Gloucester 4. Nottingham and Newark	1. Heysham and Morecambe 3. Bristol 5. Tilbury, Southend

[1] The chief railway engineering works of the line.

TABLE IV

THE UNDERGROUND RAILWAYS AND LONDON GENERAL OMNIBUSES 1920

	Metro. & District.	London Electric.	City & S. London.	Central London.	Total.	Omnibuses.
Mileage . .	25.5	24.3	7.3	6.8	64	
Stations .	49	55	15	15	134	
PASSENGERS (In *millions*)						
Ordinary .	95.5	113	26.5	39.5	274	770
Workmen .	24.5	33	12	4.5	74	
Season .	28	19	2.5	6.5	56	
Total . .	148	165	41	50.5	404	770
RECEIPTS (In £ *thousands*)						
	2,678	1,850	385	600	5,505	6,782

EXERCISES

1. Make a table giving an analysis of the great railway "exchanges," *e.g.* London, Birmingham, Carlisle, showing their original importance as traffic centres (as river-towns, road centres, etc.), the lines meeting there, their physical suitability for railway building, the industrial demand and the growth of the towns as a consequence of their railway facilities.

2. Make four separate maps showing the four groups of railways in Great Britain. Use map, p. 131.

3. Which lines connect London and Carlisle, and how are they grouped?

4. From your atlas draw a sketch map of the London and North Western and Lancashire and Yorkshire main line and *its branches*. Explain the advantages of the branches (1) to the towns served, (2) to the main line.

5. What goods would you expect to find in bulk in the trucks of the Great Northern Railway running to London.

6. Show the advantages and disadvantages of transport by rail as compared with canal and coastwise traffic.

7. Tabulate the railways and chief towns on their routes from (1) London to Edinburgh, (2) London to Exeter, (3) London to Dover, (4) London to Cambridge. Make a rough vertical section of one of the routes.

8. Draw a map of the Underground Railways showing the exchange stations (*a*) for main lines, (*b*) for tubes.

9. From Tables I. and II. find the approximate average interest on the railway capital for 1920.

10. Summarise the advantages of electrifying existing railways and show why it is not more commonly and rapidly done.

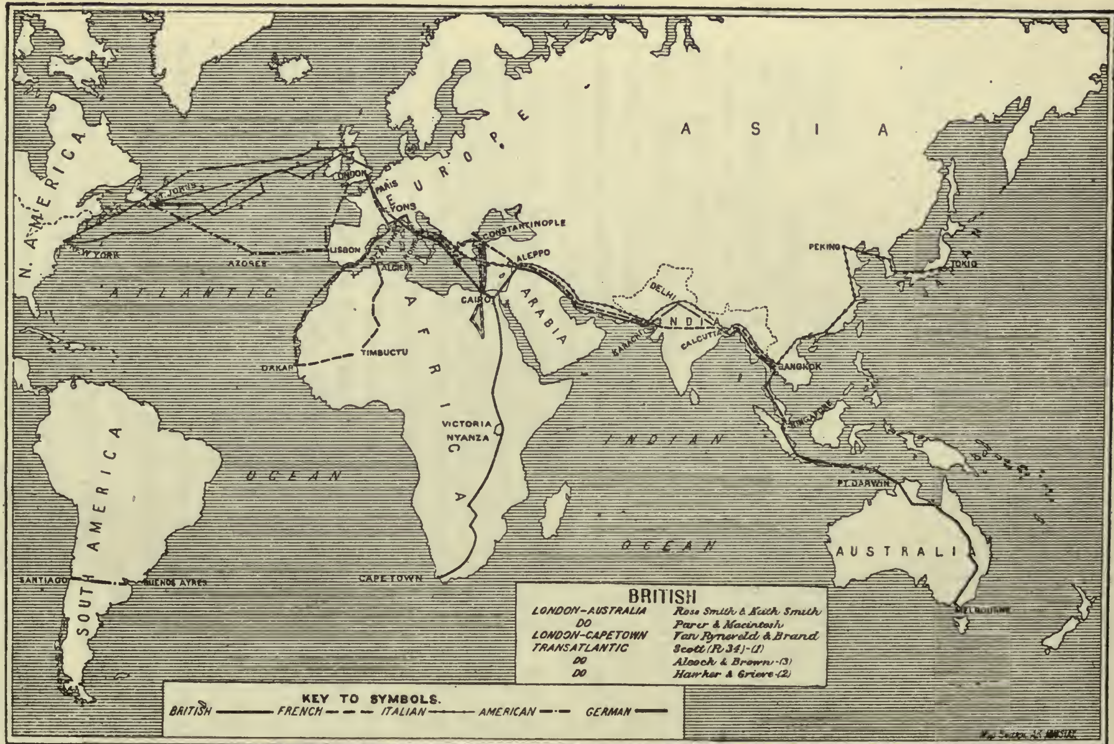
CHAPTER XIII

AVIATION

The Steam-engine revolutionised industry in the eighteenth century and transport in the nineteenth century. The great expansion of industry demanded rapid and cheap transport over land and sea. The demand was satisfied as it grew, and the country never realised till now how swiftly industry and trade can be paralysed by the failure of transport. In the last years of the nineteenth century steamship and railway companies competed keenly in speed of transport. Express trains reached fifty to sixty miles per hour and ocean liners thirty miles per hour, but the advance of a few miles per hour was made at enormous increase of cost and some risk. Steam had reached its economic limits at fifty miles on land and twenty-five on sea.

Gas and electricity are much used in industry instead of steam, but both depend on coal, and the difficulty of carrying supplies (gas and electricity) make them unsuitable for transport. Electric railways are much used in London and its surroundings, but the cost of electrifying main lines prevents their general use. Electricity is specially valuable on the underground and local lines of London where stopping and starting are frequent and trains must rapidly get up speed. It enables trains to be run at intervals of 2½ to 3 minutes. Oil now replaces coal in many steamships as it saves tonnage, space and labour, and with the turbine has greatly improved the steamship.

The twentieth century brought its revolution in transport *speed*. *The Petrol Engine* with a record (1921) of ninety-nine miles per hour on the track has driven the horse from the road and competes successfully with the railway engine. There are now



By permission of H.M. Stationery Office.

FIG. 35.—EXPERIMENTAL AND RECORD LONG DISTANCE FLIGHTS

some 4,000,000 motor-cycles and cars in Great Britain, many of which could cover sixty miles per hour on the road. The light and heavy lorry are fast and convenient means of transport. The roads have recovered their early importance in the industrial and general life of the country. The petrol engine runs best and most efficiently at high speed. It and its fuel are remarkably light for the power produced. It has opened a new era in rapid transport. (*Cf.* Chap. XVIII.)

From very early times man has been ambitious to fly; to conquer the air as he has conquered land and sea. After years of experiment with gliding machines, engineers added to them motor engines and in 1908 Orville Wright, an American, made a flight of one hour. In 1909 Bleriot flew the Channel and England was brought nearer to the whole world. Distance is a matter of time and money. To-day New York is not more distant in time than was Edinburgh a century ago. The train and steamboat revolutionised the relations of mankind, making all men neighbours and fellow workers, and loading the meal table with supplies from all the corners of the earth. The aeroplane and airship have brought New Zealand within the range of a fortnight's journey.

The air triumphs of 1919–20 foreshadow the reconquest of land and sea. Every such advance brings Great Britain into closer contact with the nations. Men now fly to Paris after breakfast, transact their business and return in the evening (return fare, 1922, £12; *cf.* rail and boat fare, £7 11s. 4d.). Daily services (worked by English, French, Belgian and Dutch companies) are established between London and Paris (223 miles), Brussels (210 miles, £9 9s.), and Amsterdam (258 miles, £18 18s.). Thence passengers and mails fly to the great towns of Europe, Egypt and India. (See map.) From Toulouse services run to Spain and Morocco, from Paris to Warsaw, and from Rotterdam to Copenhagen.

The excellent railway service in the United Kingdom makes an air service less necessary there than in the British Empire,

FIG. 36.—EUROPEAN AIRWAYS

within which it has established a new bond of great importance. (Table I.) British civil aviation since 1918 has been less developed than that of France and Germany, but the insular position of the British Isles in relation to each other, to the Continent, to the Dominions and Colonies and to America make the development of air traffic an enterprise of first rank. The Air Ministry has subsidised approved aeroplane firms taking part in the air service to Paris, Brussels or Amsterdam.

The aeroplane and airship contrast and compare with the train and steamship respectively, but are both much cheaper to build and to work. The expensive railway track, numerous stations and large staff are dispensed with (the motor car co-operates in this with the aeroplane). The costly, extensive and heavily equipped docks are exchanged for the airship station. Its great freedom in time, direction and range, its cheapness, flexibility and speed make the aeroplane (range 300 to 400 miles) of great value for continental transport of passengers, letters and valuable or urgent goods. The well-distributed large towns, and the absence of great mountain ranges and extensive forests make Europe particularly suitable for aeroplane traffic. Aircraft are still in their infancy and new uses continue to be invented. Aero-photos are being used for the exact survey and mapping to scale of town and country, of developed or unexplored lands.

The Airship with its range of 3000 to 4000 miles is suitable for ocean and world transport, for mountainous and forest-clad regions, and for exploration. These huge structures (700 to 800 feet long) are costly and difficult to build. They need special building-sheds and housing, large crews (30 men), enormous supplies of gas and elaborate equipment. They are slower in starting, flight and landing than aeroplanes, and require great skill. But they carry large supplies of petrol and have a great range of continuous day and night flying.

Airships are built at Barrow-in-Furness and Glasgow, and the Government works at Cardington, near Bedford. They have stations at Howden (near Goole) and Pulham (South Norfolk), where they can be moored to great towers, 100 feet or more high, which by lift and by mains convey passengers, petrol, gas and water direct to the airship. It is proposed to build much bigger airships to carry a hundred passengers and several tons of goods for world transport. To encourage the formation of a British Commercial Airship Company and develop airship

LATEST REPORTS of WEATHER on LONDON – PARIS AERIAL ROUTE. MAY 9TH. 1921.

Time of Observation. G.M.T.	PLACE	WIND (Speed in m.p.h.)		GENERAL WEATHER.	CLOUD.			VISIBILITY.	WEATHER in preceding two hours.
		Surface.	2000 feet (Direction in degrees from North)		AMOUNT (0=Nil, 10=Overcast.) Low.	High or Medium.	Height of Lowest. Feet.		
0700	Croydon	S. 10	210° 26	Cloud increasing	9	0	1500	7 miles	Cloudy
0700	Biggin Hill	S.S.W. 15		Fair	5	0	1500	7 miles	Cloudy
0700	Lympne	S.S.W. 10	210° 16	Cloud increasing	7	0	800	7 miles	Fair
0700	Beachy Head	W.S.W. 10		Cloud decreasing	2	1	2500	4 miles	Fair
0700	Channel – From Hythe . Beachy Head							4 miles 4 miles	
0700	St. Inglevert	S. 2		Slight mist	2	0	4200	4 miles	Fine
0700	Abbeville	S.W. 1		Slight mist	1	2	4200	4 miles	Fine
0700	Le Crotoy	S.W. 2		Fine	0	2	–	7 miles	Fine
0700	Le Bourget	Calm		Slight mist	0	7	–	4 miles	Mist

FORECAST of WEATHER up to 7 p.m. to-day Monday.

	Confidence Letter.	District LONDON AND S.E. ENGLAND.	Confidence Letter	PARIS AND N.E. FRANCE.
Wind at Surface	B	S. to S.W., 15 - 20 mph	B	S to S.W., 10 - 15 m.p.h
Wind at 2000 feet	B	About 225°, 20 - 25 mph	B	200° to 220°, 20 - 25 m.p.h.
Weather	B	Cloudy, occasional showers, thunder locally, fair intervals	B	Mainly fair but cloudy at times, some local showers
Cloud Amount and Height	B	5/10 - 10/10 : below 1000 feet at times	B	Varying 4/10 to 8/10 about 2000 feet
Visibility	B	Mainly 5 - 10 miles	B	5 - 10 miles

Meteorological Office, Air Ministry, Kingsway, W.C.2

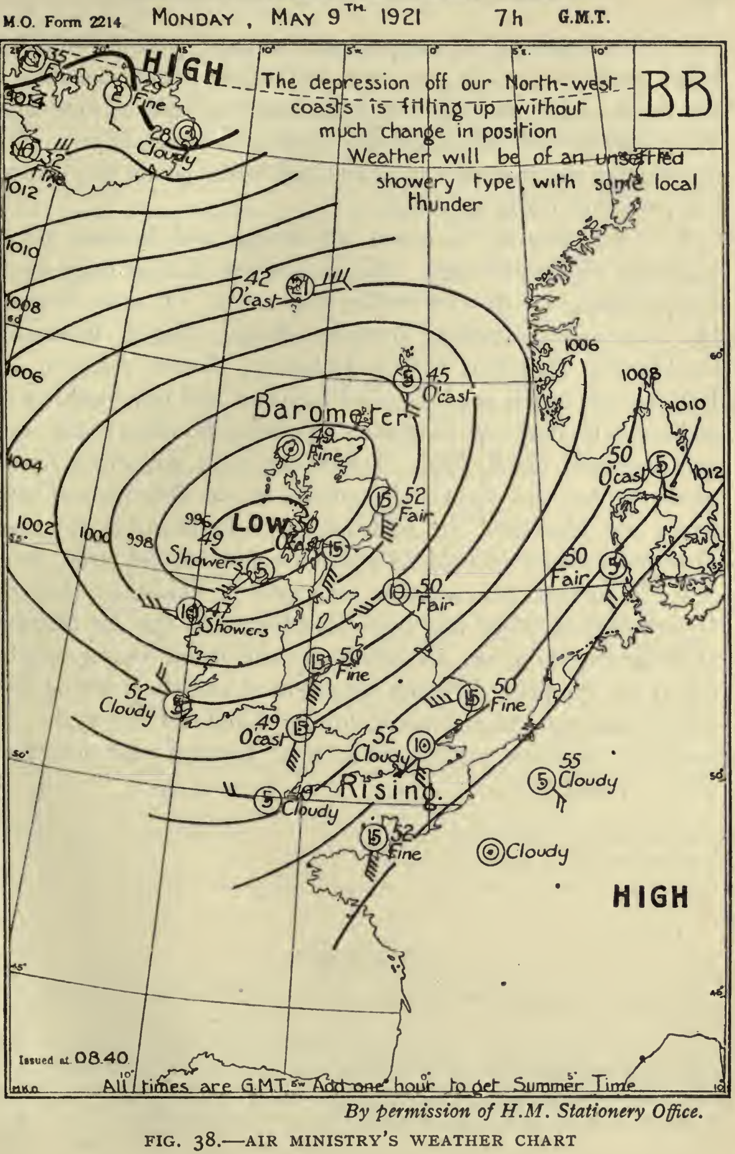
By permission of H.M. Stationery Office.

FIG. 37.—LONDON–PARIS AIR ROUTE. WEATHER FORECAST

traffic the Government offered every assistance, including six airships (two being Zeppelins), great quantities of material and plant and the use of Cardington and Pulham bases with skilled workers. The time for long-distance journeys can be reduced to one-fourth of present rail and steamer times and the fares lowered.

Aircraft have already reduced the time of transit by at least half. Where transhipment from train to boat and boat to train is necessary the saving of time and labour is still greater. *R* 34 flew to America (108 hours) and back (75 hours) in a week,

CHART OF WEATHER IN NORTH-WESTERN EUROPE.



By permission of H.M. Stationery Office.

FIG. 38.—AIR MINISTRY'S WEATHER CHART

and it is estimated that the proposed airship (speed 80 miles per hour) would reduce the journey to India from twenty-one days to five days, and to Australia from six weeks to eight or nine days. Where speed and directness are required aircraft have a great future; for the transport of heavy and bulky goods they cannot compete with trains and ships

The Air Ministry controls all flying, and licenses pilots, engineers and aerodromes. The authorities of most large towns are providing aerodromes within easy reach. Of these Croydon (for continental traffic), Lympne (Kent), Castle Bromwich, Cricklewood (London, N.W.), Didsbury, Hinton Admiral and Renfrew are much used for civil aviation and have wireless installations (p. 169). Croydon has a lighthouse for night flying and a mooring-mast for airships. Felixstowe is an important hydroplane station; sea-ports and stretches of the Thames and other rivers are also used for hydroplanes. Landmarks are being provided—names of stations painted boldly on the roofs, etc.

So important are weather forecasts for aviation that the Meteorological Office has been transferred to the Air Ministry at Kingsway, London. In addition to the usual evening weather report for the press, it issues special local and short-period forecasts (morning and afternoon) for the London-Paris routes. It sends out wireless reports daily from London and Aberdeen. (Figs. 37 and 38.)

TABLE I.—AVIATION RECORDS

Date.	Machine or Pilot.	Flight.	Record.
Nov. 1918	Handley-Page biplane; 40 passengers	Over London	Passenger carrying
Feb. 1919	Giant Farman aeroplane; 14 passengers	Paris to London	3¼ hrs.
May 1919	Col. W. D. Beatty	From Madrid to London	12 hrs. (two stops)
May 1919	American seaplane	Newfoundland to Lisbon (called at Azores)	Transatlantic flight
June 1919	Capt. John Alcock and Lt. Brown	Newfoundland to Clifden, Ireland	Ditto non-stop 16 hrs. 12 min.
July 1919	British Airship *R* 34	Scotland to New York Return journey	Ditto Airship 108 hrs. 75 hrs.
Aug. 25, 1919	Commercial Aeroplane	London—Paris	Air service inaugurated
Nov.-Dec. 1919	Bros. Ross and Keith Smith	London to Darwin, Australia, *via* Egypt and India (11,500 miles) London to Adelaide (15,000 miles)	Distance Reliability 27 days 20 hrs. Actual flying time, 153 hrs.
Feb.-Mar. 1920	Van Ryneveld and Brand	London to Cape Town, *via* Cairo	Cairo to Cape
Sept. 1920	Sadi Lecointe	Won Gordon-Bennett Race (188 miles)	66 min. 8 secs. Speed 170½ mph

EXERCISES

1. Tabulate the relative advantages and disadvantages of aeroplanes, airships, trains, and ships.

2. Which is the central point in the Eastern Hemisphere for Imperial air services? Draw a sketch map showing the main flights, with stations and distances, from this centre.

3. Write a short account of the effect upon transport of introducing petrol engines.

TABLE II

BRITISH CIVIL AVIATION TRAFFIC
(Including Continental Services) [1]

March 1920 to March 1921

No. of Machines.	Aeroplane.	Carried.	Value of Goods.	Letters Carried.
1,460 to the Continent .	Flights. 26,130	Passengers. 42,400	Exports. £336,000	To Continent. 105,600
1,280 from the Continent .	Miles. 812,200	Goods—lbs. 280,000	Imports. £638,000	From Continent 80,000

[1] Owing to the heavy French subsidy and the reduction of fares, English companies could not compete for traffic and closed their services in December and February 1921. By arrangement with the Air Ministry the daily service was reopened in March. An average of seven passengers per machine has been carried since that date.

TABLE III

Airships *R* 36 and *R* 38 (British built), *L* 71 (Zeppelin surrendered), and a proposed larger ship for long distance service.

Gas Capacity. Cubic feet.	Lgth. Feet	Engines.	Nom. Lift (Tons)	Speed. Miles p.h.	Range. Miles.	Load.		
						Crew.	Pass.	Gds. tons.
R 36 2,100,000	675	5 (1,570 h.p.)	64	65	4,000	28	30	2
R 38 [1] 2,724,000	695	6 (2,100 h.p.)	83	45 to 70	9,500 to 5,250 [2]	35	40	5
L 71 2,430,000	750	6 (1,560 h.p.)	78	75	6,000		60	15
Prop. Ship 4,000,000	800		120	80			100	5

[1] *R* 38, built at the Air Ministry's works at Cardington, was sold to U.S.A. She broke her back on her trial flight and fell into the Humber in flames (August, 1921). It was estimated she would fly to Egypt in a non-stop flight in forty-eight hours.

[2] The actual range is much reduced by flying at top speed.

CHAPTER XIV

TRAFFIC IN THE NARROW SEAS

ISLANDS are the nurseries of sailors and the home of ships. Given sailors and ships, sea-roads are the easiest and cheapest, often the quickest means of travel and transport. The British Isles, surrounded by narrow and sheltered seas and channels, enjoying double tides, possessing a highly developed coastline with natural harbours, deep inlets and innumerable rivers, offer every encouragement to a sea-faring people.

Moreover, the British Isles are so numerous and so near to each other and to the Continent that a system of sea traffic is essential. Water-ways are the cheapest and often the quickest and most convenient means of transport. The great and varied resources of the islands and the enterprise of the British people have developed the most complete and remarkable system of coastal and narrow-seas communication in the world.

Successive maritime peoples invaded the land, some were already famous for their daring and skill on the seas. Each played its part in developing sea traffic. Before the Romans came there was regular traffic across the Straits and probably from Cornwall to the west of Gaul (Bordeaux). The Romans knew the value of safe communications. They established three Kent ports and joined them to Watling Street: Richborough (*Rutupiæ*), oldest and for them most important, recently revived for war transport (ferry work); Dover (*Dubris*), for nearly 1000 years the principal gateway to the Continent and chief of the Cinque Ports; and Lympne (*Portus Lemanæ*). Later *Portus Magnus* (Porchester) and *Clausentum* near Southampton were linked to London by roads, and were much used.

The ease with which innumerable bands of Anglo-Saxon and

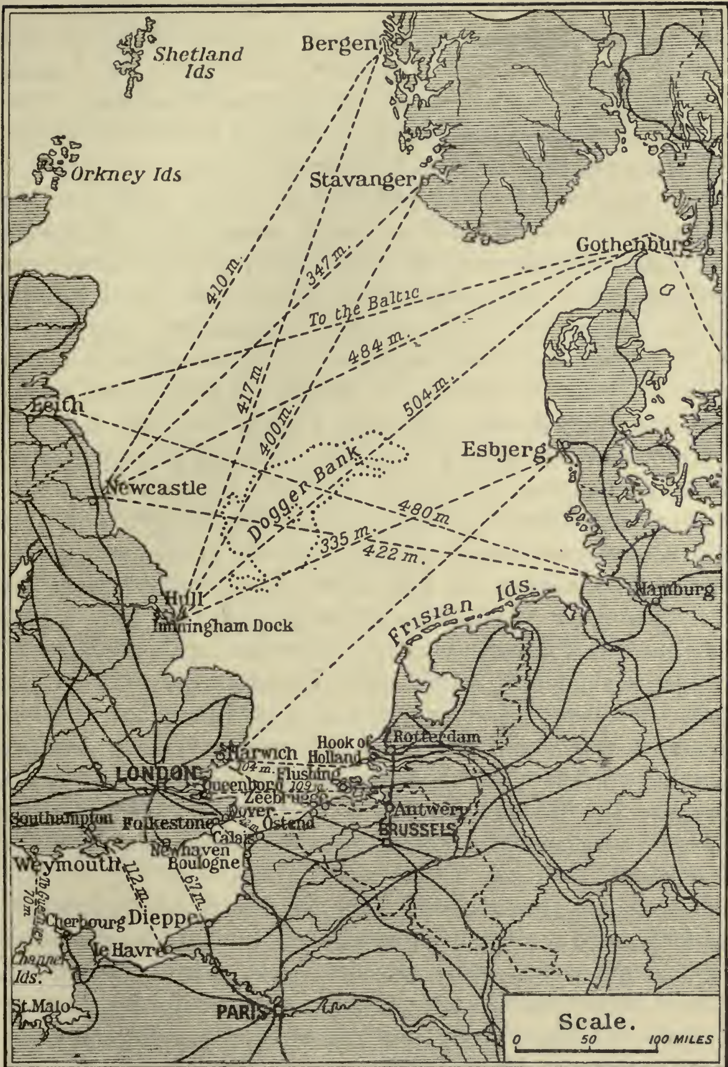
Viking invaders landed on all parts of the British coast proved the accessibility of the country. Then were founded many of the coast villages which have grown into ports and to-day carry on the overseas traffic. Stung by repeated Danish attacks the Saxons were compelled to meet them on their own element. Thus Alfred founded the English Fleet (887). He sent out explorers to the north of Europe and the Baltic. Athelstan encouraged sea enterprise by giving the rank of Thane to merchants who made three foreign voyages.

The Normans, however, were not sailors, and English overseas trade for centuries was mostly done by foreign vessels. Saxon, Danish and Norman ships were long boats carrying one mast and sail[1] and rowed by forty to sixty men with long oars. They were useful not only for cross-channel work but for river traffic, and penetrated far inland to York, Lincoln, Godmanchester, Grantchester (Cambs), Norwich, London, Winchester. Exeter, Chester, and to Cologne and Rouen across the seas, This sea-river traffic established a great many inland river ports, now mostly abandoned. With similar ships men made long voyages—the Crusaders to Palestine.

The piracy of the Vikings was a notorious terror both on land and sea. The bad tradition was kept up in the North Sea to the eighteenth century and in the Mediterranean to the nineteenth. This menace to shipping and the French wars stimulated efficiency in both building and seamanship. By 1250 ships were decked, had cabins and two or more sails.

Knowledge of seas and countries was rapidly developed. The Vikings discovered Ireland, Greenland and Newfoundland before A.D. 1000, and this knowledge was not lost. Ships ran westward to Greenland, southward to Spain and eastward to the Baltic. Edward I., about A.D. 1300, claimed the sovereignty of the Narrow Seas (between Britain and the Continent) and used his fleet—based on the Cinque Ports—to enforce it against piracy and Dutch contempt. Until Tudor times no purely naval boats

[1] See *Bayeux Tapestry*.



THE MAPPA CO., LTD., LONDON.

FIG. 39.—CHANNEL AND NORTH SEA PORTS AND ROUTES

were built. The mercantile marine was commandeered and equipped for sea warfare (*e.g.* Sluys, A.D. 1340). The English mastery of the Narrow Seas was maintained and later grew into the mastery of the High Seas which keeps all waters safe and open, not only for British but for all ships.

The nearness of the South-east to France and the Low Countries and the fact that it was the most productive in wool and cloth gave rise to a ring of mediæval ports from London to Southampton. The *Cinque Ports* (afterwards eight) became famous and received special privileges in trade (see map, p. 227.) By the close of the Middle Ages well-organised trade routes were established between Great Britain and Ireland and North-west and South Europe—especially France, Spain and Italy.

The nineteenth century brought a rapid and great expansion of this intercourse. The newly developed industries by means of the railways flooded the ports with goods for export. Steamboat services ran from ports new and old to all parts of the British Isles and of the Continent. Many submarine cables were laid (from 1845): eight cross the Channel and Straits, six run to Ireland, four communicate with North-west Europe, several link up the smaller islands and ports of the coast. Wireless and air services are the most recent developments of this great system of intercourse with our nearer neighbours. There is wanting only the Channel Tunnel to complete it. Our navy enables us to treat the British seas like a great encircling moat crossed by many bridges which we can close at will.

Our varied resources and the rich home and continental markets made a great development of commerce inevitable as soon as the steam-engine came into use. Every important railway seeks coastal outlets for the products of the districts served by it. Some railways have, single-handed, built prosperous ports, as Grimsby, Newhaven, Fishguard, Heysham. Others have developed old ones, as Bristol, Glasgow, Hull, Dover. From these ports they project themselves across the narrow seas and along the coast by means of their own steamboat services. (See map, p. 131.)

A highly-developed coast-line and the many navigable rivers have greatly encouraged the growth of small seaports for coast-wise traffic. This is a valuable and cheap supplement to the inland service. Heavy cargoes—especially coal—are frequently delivered by this means. The east, south and west coast towns are supplied with seaborne coal much more cheaply than it can be brought by rail. The Tyne, Cumberland and South Wales ports have largely grown up on the coal traffic. The manufacturing Midlands and North have their main outlets on the great east and west estuaries—Forth, Humber and Thames, Clyde, Mersey and Severn. The fishing industry uses its own ports, both large and small—especially those that have rapid train services to large towns. Grimsby, Hull, Aberdeen, Fleetwood, Lowestoft, Milford Haven, Plymouth and Yarmouth (in order) receive the heaviest landings.[1] Ireland carries on considerable coast-wise and oversea traffic through her north, east and south ports, each of which is linked up with one or more English or Scottish ports and railways. Queenstown and Waterford have regular services to London. The Channel Isles are served by boats from Southampton and Weymouth. The Isle of Man and the islands off West and North Scotland have regular, if in some cases infrequent, steamboat services. (Maps, pp. 131 and 249.)

The east-coast ports have considerable passenger and goods traffic with North-west Europe and the Baltic while those on the south and south-east coasts are engaged more in cross-channel passenger and mail services. They carry also perishable goods—fruit, vegetables, dairy produce and manufactured goods that require quick transport. Fast packet-boats are used for this work, heavier steam tramps run from London and the east and west industrial ports. The demands of war created the Channel ferry-port at Richborough, to transport not only war

[1] *Cf.* map, p. 103.

material but railway engines and rolling stock to France. It is likely to remain a specially equipped port and with the projected Channel tunnel may serve especially to link up the British and European railways.

TABLE I

NET TONNAGE OF VESSELS ENGAGED IN BRITISH COAST TRADE

Vessels Engaged in the	Net Tons Arrived.		Net Tons Departed.	
	1913.	1920.	1913.	1920.
I. Coastwise Trade of the British Isles				
British vessels	22,500,000	12,000,000	22,000,000	12,600,000
Foreign vessels	280,000	264,000	286,000	269,000
II. Great Britain and Ireland B.	12,000,000	11,800,000	12,000,000	11,000,000
II. Great Britain and Ireland F.	14,000	58,000	14,000	65,000
Total British vessels	34,500,000	23,800,000	34,000,000	23,600,000
Total Foreign vessels	300,000	322,000	300,000	334,000
Grand Total. Tons	34,800,000	24,122,000	34,300,000	23,934,000

The importance of British Coastal Trade and the extent to which it is carried on by British vessels is shown by the above table for the years 1913 and 1920. The cross-channel trade between Great Britain and Ireland is given separately.

The number of men engaged in the coast service is 70,000.

The total of arrivals and departures gives the amount of coast traffic and can be compared with the railway traffic in goods (Table I.). We see, too, that the foreign vessels are almost negligible. The 1920 coast trade of Great Britain is little more than half the amount carried in 1913.

EXERCISES

1. On a sketch map show the coalfields near the coast, the coal ports on each, and name the chief countries to which the coal is sent.

2. Construct tables of the main British lines, giving their terminal ports and the foreign ports to which their services run.

3. Which railway developed Grimsby? Show why it has become the first fishing port.

4. Describe the cargoes carried by the steamboats to and from Ireland.

5. Which ports receive most of the timber from North-west Europe? Where does it come from, and what is exported in exchange?

6. May we deduce from Table I. that the Home Trade of the British Isles was in 1920 very little greater than Great Britain's trade with Ireland? If not, how was it carried on? Explain the great drop in British coast trade in 1920 as compared with the small drop in Irish-British cross-channel trade.

CHAPTER XV

OCEAN TRAFFIC

The discovery of America placed the British Isles between two great continents. She was formerly on the outer fringe of one, with little stimulus to and much opposition in sea traffic. Her sailors, however, had more than the common knowledge of and skill with wind and current, chart and compass; her ships, small and stoutly built, were well suited to the adventures which in the next century opened up a new world and established many of the ocean routes now in common use. The Atlantic was to become the highway of the world while the Mediterranean ports declined, the British western and southern shores, fitted by nature to harbour shipping, became the emporium of the world, but not without a long struggle.

In Tudor times the British imagination was fired by tales of discovery and treasure; Henry VIII. built a great four-master, the *Great Harry*. Rich Englishmen (*e.g.* Raleigh) not only put their wealth into new ships, but embarked in them to lead a life of adventure and discovery. While Drake circled the world in the south, other explorers tested every opening in the new continent and far into the west and east Arctic to find short and safe northern ways to the east, but in vain. Other traders following on the heels of Portuguese and Dutch explorers opened to the British the African coast routes and the Asiatic seas.

Shipping facilities received increasing attention at home. Lighthouses were erected (first Eddystone, 1696); wet-docks were built (Commercial Dock, Thames, 1660, Liverpool Dock

1709); Yarmouth harbour was improved. Towards the end of the eighteenth century, Glasgow, though situated on a very shallow stream, and Belfast, with their important growing industries behind them, began to develop their export and ship-building trade for which they now stand pre-eminent. The British coasts were surveyed and charted, and a chronometer for determining longitude was invented. Companies for marine insurance were organised. Lloyd's developed the Register of Shipping and undertook the classification of ships ("A1 at Lloyd's").

Meanwhile this great development of British shipping was well supported by the internal growth and production. The great development in agriculture beginning in the late seventeenth and the Industrial Revolution in the late eighteenth centuries, increased production enormously. We exported corn up to 1792. The coal trade was growing rapidly. The wars with Holland, then France, and last America, had been a great strain upon our resources and shipping, but our shipping doubled between 1782 and 1792 and England became the richest nation in the world. London had become the centre of world-traffic but the western ports, old and new, were rapidly developing in their trade with America. Harbours, docks, breakwaters, lighthouses were built in many parts. Canals were cut to feed them and, *e.g.* in the case of the Kennet and Avon Canal to Bristol, to avoid French attacks in the Channel.

At this point, steam was introduced, but its use on ships developed slowly. The first experiments with small steamboats were made in Scotland. These were followed up in America and about 1815 a number of river-steamers were in use. Three years later the *Rob Roy* began to ply between Glasgow and Belfast. Coast steamers now became common, especially on the west, and in 1824 the General Steam Navigation Company (London) was formed for east-coast and continental traffic. In 1819 the *Savannah* crossed from Liverpool to America, but it was nearly twenty years later when regular services were begun from

Bristol and Queenstown to New York. In 1838 the Cunard Company was formed and built a fleet of steamers to carry the mails to America. American competition came in 1850, but was not successful. The White Star and a dozen other well-known British steamship companies followed in the next twenty years and French, German, Dutch, and American companies soon entered into competition on the Atlantic. The period 1840 to 1900 is remarkable for the great number of steamship companies —British and foreign—formed. Meanwhile, steam traffic was developing on the other great routes. Some other pioneer companies were the Royal Mail Steam Packet Company (Central and South America), Peninsular and Oriental (Egypt—later to India and Australia), Castle Line (South Africa). There are now a great many British steamship companies of which 50 have a tonnage of over 61,000 each, including 34 of over 100,000 each; some, *e.g.* the Cunard, have over 1,000,000 tons.

This great growth of steam shipping was accompanied by other improvements. The screw propeller (1840) and iron ships, first built at Birkenhead (1824) and Millwall, Thames (1835), rapidly found favour. The *Great Eastern* (1858), a paddle steamer built to carry 4000 passengers, was " before her time," and was later used to lay submarine cables. *Steel* ships followed from the great ship-building works of the Clyde, Belfast, Tyne and Wear ports. The largest now overtop 50,000 tons. Steam *turbines* are largely employed instead of steam-engines, to save both space and coal and give increased speed The fastest steamer afloat is the *Mauretania* (25 knots—28 miles per hour). She crossed the Atlantic in 4 days 11 hours.

In nearly 2000 recent ships a further economy of labour and storage space has been made by using oil fuel. Some new vessels are being fitted with Diesel (internal combustion) engines. In spite of the invention of steamships more than half of the world's goods was carried in sailing vessels in 1870, and to-day sailing ships, mostly steel, having a tonnage of nearly 500,000 tons are in use. Few are British.

TABLE I

To Illustrate the Change of Character of Ships

Tonnage of New Shipping in United Kingdom

Year.	Wooden Ships.	Iron Ships.	Steel Ships.	Notes.
1860	**154,000**	86,000		Other steel vessels built 1920 were: Sailing, 15,670 tons; Motor, 87,000 tons
1880	18,000	**447,000**	36,000	
1900	8,700	16,000	**1,100,000**	
1920	660	3,794 (concrete)	**1,953,000**	U.S.A. built 2,476,000 tons in 1920

1. British shipyards in 1913 built 58 per cent. (*i.e.* nearly 2,000,000 tons) of the world's new ships, in 1919 only 23 per cent., but in 1920 35 per cent. At the end of 1920 they were building half of the world's tonnage (6,000,000) then under construction—thus showing rapid recovery.

2. The British output included fifteen ships of 10,000 tons or more and 168 of 5,000 to 8,000 tons (1920).

3. One-third of the new British tonnage is fitted with the steam turbine. Iron ships are not now built, but concrete has been used for smaller ships and barges.

The most striking and costly shipping facilities are ship canals, of which the Panama (opened 1st January, 1916) is 50 miles long and cost £75,000,000. In England the Manchester Ship Canal (1894) cost £15,000,000 and is 35½ miles long. It makes Manchester an "inport" of Liverpool. In 1913 it carried nearly 6,000,000 tons. For Imperial traffic the most important is the Suez Canal (1869), 90 miles long. It is now practically owned and controlled by the British Government but is open to *all* nations in peace and war. It saves many days in the journey to East Africa, India (Bombay is 5000 miles nearer) and East Asia, but less to Australia.

The Panama Canal is less important to Britain than to the United States of America, but, while Sydney is almost as near as *via* Suez, New Zealand is 1000 miles nearer and ships from Liverpool for the towns of Western America save from 1000 miles (Valparaiso) to 6000 miles (San Francisco). For trade

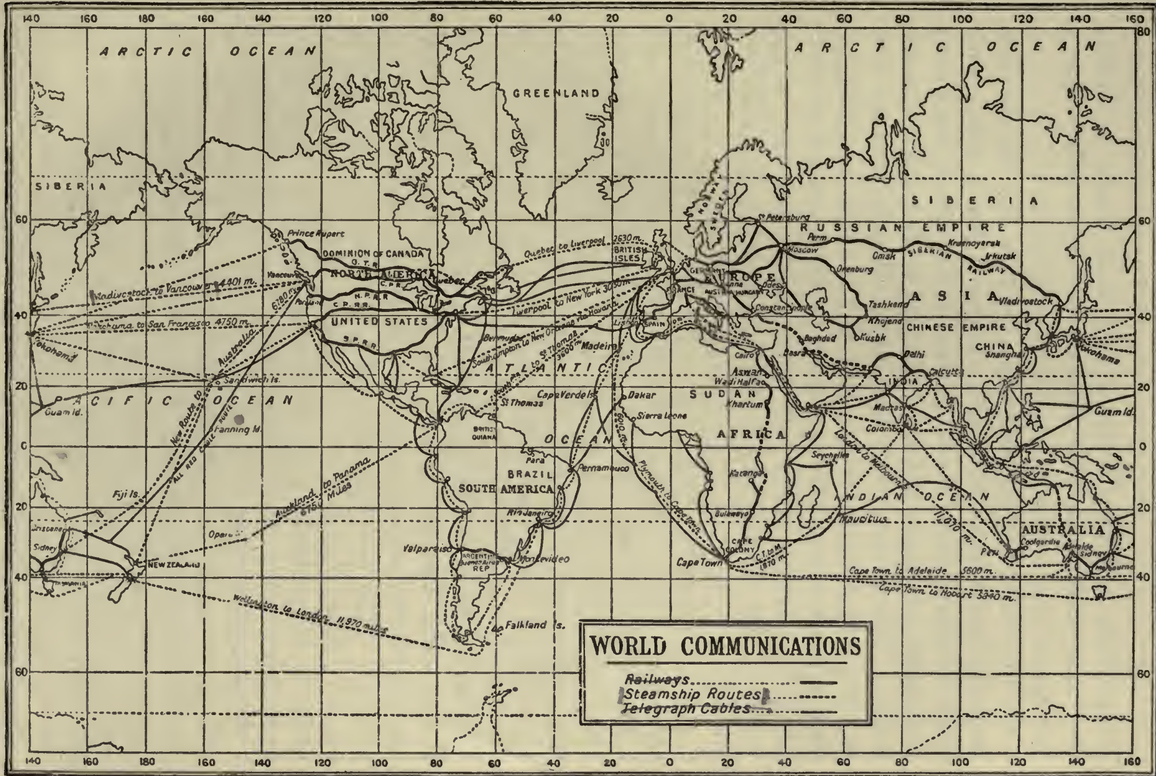


FIG. 40.—ROUTES ROUND THE WORLD: STEAMSHIP, RAILWAY AND CABLES

competition, however, it places New York nearer to Sydney (by 1500 miles) and New Zealand (by 2500 miles) than is Liverpool.

Of the world's great mercantile service, the British Isles normally builds more than half, and owns nearly half. Many ships are equipped for special purposes. The fastest boats carry passengers and mails, and are fitted with every convenience and luxury. Others carry only live cattle. Nearly 1000 are vast floating refrigerators for carrying chilled meat or fruits. A similar number of oil tankers carry petroleum, much of which comes to British ports. Of these eighty are steel sailing vessels. But the majority of steamships are big cargo-carrying "tramps."

Among our keenest competitors for the world's traffic were Germany, France, Holland, United States and Japan. All except Germany still compete, the United States of America being second only to the British Isles. Germany's ocean-going ships were either destroyed or surrendered, the world's largest vessels going to the United States of America (*Leviathan*, 54,000 tons) and to Great Britain (*Imperator*, 52,000, now a Cunarder). The British Dominions—especially Canada on the Atlantic and Pacific—and Australia and New Zealand are also developing important steamship services. In 1920 they owned 2,250,000 tonnage. The new Commonwealth Government Line of five big fast ships (14,000 tons) will shorten the journey to Australia by three or four days (London to Fremantle thirty days) by sailing direct to Suez. They carry cargo and passengers.

While it is of first importance that the Empire should be adequately served by the best means of communication—steamship, cable, airship, and wireless—British prosperity still depends upon the commerce and carrying of the world's trade. Foreign commerce employs two-thirds of British shipping and accounts for nearly two-thirds of British trade.

TABLE II

CHIEF OWNERS OF WORLD'S SHIPPING, 1920

(100 tons and upwards)

	Steam.		Sailing.		Total.		Pre-war, 1913-14 Steam & Sailing.	
	No. of Ships.	1000 Tons.	No. of Ships.	1000 Tons.	No. of Ships.	1000 Tons.	No. of Ships.	1000 Tons.
British and Dominion	9,779	20,143	1,052	440	10,831	20,580	11,287	20,432
U.S.A. .	3,641	12,456	1,321	1,386	4,962	16,049	2,773	3,035
French .	1,400	3,963	358	282	1,758	3,245	1,552	2,201
Germany .							2,321	5,082
World's Shipping .	26,513	53,906	5,082	3,409	31,595	57,314		

1. 2197 British vessels (7,638,000 tons) were lost during the war. In 1920 we were still two million tons short.

2. The Dominions (1920) owned 2270 ships with a tonnage of 2,252,000.

3. Germany's shipping was reduced to 673,000 tons. Her large vessels were surrendered.

4. The United States built rapidly during the war and in 1920. *Cf.* Table I.

5. In 1920, 7,500,000 tons of shipping were in building, of which 3,730,000 tons were in British yards, and 1,770,000 in America.

6. Nearly 300,000 men are employed on British ships, including fishing vessels.

The great shipbuilding race between British and German yards (1907—1914), in the speed and size of ships led to great changes in building-yards, river-channels, docks and harbours. Vessels of 50,000 tons, 900 feet long, and drawing up to 59 feet of water, could not be built and accommodated in ports without re-dredging the rivers and harbours, and building larger wet and dry docks. This great expense limited their ports of call to Liverpool, Southampton and London. London's new docks are being built nearer and nearer to Tilbury and the sea. Most large river ports have found it necessary to build outports for ships of 20,000 to 25,000 tons. The Tyne, Thames, Bristol Avon, Clyde, Liffey and Cork harbour should be carefully examined on a good map for outports. In many respects all coastal ports from Harwich to Southampton or even to Plymouth, Bristol and Fishguard may be called outports of London, whose passengers and light goods they convey to the Continent or to America. Few passengers leave London by the Thames, but many arrive and depart *via* Tilbury. Southampton is London's great passenger port for the United States of America, Canada, South America, Mediterranean, and South Africa.

TABLE III

BIGGEST BRITISH SHIPS OVER 30,000 TONS

Ship.	Tonnage.	Lgth.	Spd.	Built.	Owner.
Berengaria .	52,000	882	23	1912	Cunard. (German built and named *Imperator*.)
Olympic .	46,360	882	23	1911	White Star. 2,500 passengers, 860 crew, 50,000 h.p. Cost £1,500,000
Aquitania .	45,650	868	24	1914	Cunard. 6,600 tons of coal required to cross the Atlantic
Mauretania .	30,704	762	25	1907	Cunard. 2,300 passengers, 900 crew, 1,000 tons in 24 hours. 70,000 h.p. turbines. Steamed to New York in 4 days 22 hours

Building up a great world-traffic has led to the equipment of coaling stations, repairing stations having floating or other dry docks, fortified "key" places, wireless and cable stations, and innumerable ports of call. Some of these, *e.g.* the Canaries, are not British, but most are. Trace carefully on a good map the Mediterranean, Red Sea and the ocean routes, and make a table of the different kinds of stations on each. These points of contact have been colonised, occupied, won in wars, bought or exchanged, and are essential to both British and foreign ships. In this way, the "all red" route has been carefully organised and forms the great means of communication and the material bond of the Empire (see map, p. 155).

Since 1900 there has been an increasing tendency towards purchase, control, or joint working among British colonies. The four fleets owned by the *Cunard Company*, including the new ships being built, total over 1,000,000 tons. The net earnings in 1912 were over £2,340,000. The *Royal Mail Steam Packet Company* (S. America) purchased the *Union Castle Company* (S. Africa) for over £5,000,000 in 1912, and works jointly with the *Pacific Steam Navigation Company* (S. America and Pacific). The *Furness, Withy Company* (Hartlepool) in 1912 owned or controlled over 300 ships (freighters) of nearly 1,500,000 tons. The *P. and O.*, *British and India*, *New Zealand* and *Union Steamship Companies* work jointly; many other companies have similar arrangements. The nineteenth century saw the development of industry and commerce by keen competition—a stimulating but often wasteful process. In the twentieth, amalgamation and co-operation have already gone very far in shipping, railways, banks and business houses. While this may make for economy and efficiency, it involves the risk of rings, trusts and monopolies, from all of which the community in the past has suffered heavily.

In the last thirty years the Dominions have developed rapidly, and since the war their importance in the empire has been more justly appreciated. The problem of organising and developing its resources and of binding its parts into a strong, yet free union of self-determining people, has shown the enormous importance of communication. Empires of the past have collapsed largely owing to the lack of this binding force. To be out of communication means mutual ignorance and distrust, lack of understanding and sympathy, pursuit of narrow and selfish aims and ambitions.

TABLE IV

Output of Six Building Ports, 1920

Port.	Tonnage. (1920)	Other Towns in the Group or on the River.
Glasgow	457,000	*R. Clyde.* Greenock, Port Glasgow, Dumbarton
Newcastle	365,775	*Tyne Ports.* Gateshead, Yarrow, Wallsend, Tynemouth, North and South Shields
Sunderland	314,450	*R. Wear*
Greenock	223,430	*R. Clyde.* (See Glasgow.)
Middlesbrough	195,450	*R. Tees.* Stockton, Hartlepool
Belfast	117,656	On Belfast Lough

1. These figures are much higher than in previous years, except for Belfast, which in 1919 built over 200,000 tons.

2. The record output of any year was made by Messrs. Harland and Wolff of Belfast with 220,000 tons.

3. British shipyards export about one-third of their output.

TABLE V

(*Cf.* Table IV)

Chief British Ports and Their Traffic, 1912, not Including Coast Traffic

Millions of Tons Arrived and Departed

Ports.	Net Tonnage.	Ports.	Net Tonnage.	Ports.	Net Tonnage.	Ports.	Net Tonnage.
London	24	Hull	8.2	Leith	3.4	Harwich	1.9
Mersey		Plymouth	7.5	Blyth	3.3	Methil (Fife)	1.8
(L'pool &		Glasgow	7.1	Manchester	3.3	Goole	1.4
Birkhd.)	22.6	Dover	4.5	Sunderland	3.2	Burntisland	1.3
Cardiff	16	Swansea	4.4	Bristol	2.5	(Fife)	
Tyne Ports	14.6	Middlesbro'	4.3	Grangemouth	2.1		
Southern	11.4	Grimsby	2.1	Hartlepool	2		

N.B.—The coastwise traffic of 1912 amounted to 60,000,000 tons.

TABLE VI

SAILORS AND SHIPPING OF THE BRITISH MERCANTILE MARINE

Year.	British Sailors.	Foreign Whites.	Asiatics and Lascars.	Total Sailors on British Ships.
1914 . .	212,640	31,400	51,600	295,640

Year.	Steamers.	Tonnage.	Sailing Vessels.	Tonnage.	Totals.	
					Ships.	Tons.
Dec. 1914 .	12,862	11,622,000	8,203	794,000	21,065	12,415,000
1920 .	8,113	18,111,000	448	220,000	8,561	18,330,000

1. In 1914–18 the total loss of British mercantile shipping was 9 million gross tons. To replace this 4.5 million tons were built, .75 million captured, .5 million bought. Net loss in the war, December 1917, 3.25 million tons.

2. In 1920 5 million tons were on the stocks; 56 ships were over 10,000 tons, 55 ships averaging 5,000 tons each were built for oil transport, and 426 new ships (nearly 2 million tons) were built to burn oil fuel. Of the ships at present on Lloyd's Register about 75 per cent. still burn coal, about 18 per cent. oil, 2 per cent. have motor power, and 6 per cent. are sailing vessels. Only about 4 per cent. are wooden vessels.

EXERCISES

1. Write notes for an essay on the different kinds of power used by shipping, showing their relative advantages.

2. Compare the age, growth, and present importance of the British ports on the west, south and east coasts, giving reasons for the changes.

3. Make a table showing separately the coal, cotton, wool, hardware, passenger and fishing ports. Star any that are great shipbuilding centres.

4. Account for the extent and importance of the North Atlantic traffic and communication. Table the various means by which it is carried on.

5. None of the big passenger ships run to and from the ports where they were built. Account for this.

6. Discuss the advantages and disadvantages of having a few large and a great many smaller (5–10,000 ton) steamships.

7. Describe the various ways of reaching New Zealand and compare them in respect of the passengers' time, expense and comfort. How has the war affected the choice?

8. Account for the non-British sailors on British ships. To which nationalities do they chiefly belong, and what dangers and disadvantages attach to them?

9. Compare (*a*) the number of ships, (*b*) their tonnage, in 1914 and 1920. What do the differences suggest?

CHAPTER XVI

POSTAL COMMUNICATION

Travel and transport are not the whole of communication. To-day a vast **postal system** conveys information throughout the whole world. Written messages were not very common until the seventeenth century, and were carried privately until some regular service of conveyance made a postal service possible. Letters were carried abroad by merchants. *Posting* was at first a means of travel. On the main routes were post stations where horses could be changed or hired. The system, dating from Edward III., enabled people to travel more cheaply and quickly, at first on horse-back, later by coach. Royal messengers were employed by the government to carry letters. There was a post-master in 1533, and in 1543 letters were carried to Edinburgh in four days, but this rate was too rapid to be permanent. James I. found better communication with Scotland necessary. In 1607 he appointed a postmaster for England, and in 1619 one for foreign correspondence.

There were still many private and commercial means of conveying persons, goods and letters. Special messengers were much used and most cities had their own post. Charles I. stopped this and organised a foreign post office in 1632, and a system for Great Britain 1635. Thus postal arrangements were controlled by the king, who claimed the revenue. Charles II. stopped the private collection and delivery of letters in London, and in 1710 all local town schemes were controlled by the Postmaster-General.

The improvement of roads and construction of main roads much improved the post, and Pitt organised *mail coaches* (1784) which covered ten miles per hour, and continued to carry the mails until railways were established.

The charges were very high and were collected on delivery. They varied with the distance (fourpence up to fifteen miles, one shilling up to three hundred). In 1839 75,000,000 letters were sent out—three per head of population. In 1840 *Rowland Hill* proved that collecting, sorting and delivering cost more than carriage and that distance mattered little. He suggested a penny post for half-ounce letters (prepaid). In this year the number of letters doubled, and in nine years it was five times as great. In twenty years the Post Office revenue was greater than under the old system

The service has steadily improved. *Halfpenny post* cards were introduced (1870) and the weight of penny letters was raised to one ounce soon after. Cheaper rates for matter not of a personal character were arranged for newspapers, advertisements, circulars, etc. In 1883 the *parcel post* was started. This greatly increased trade by enabling goods to be bought and delivered through the post which conveys them quickly to all parts.

As other countries had also developed postal services the International Postal Union (1885) and the Imperial Penny Post (1908) were organised. Before 1840 it cost fourpence to send a letter twelve miles, in 1914 a penny took a letter to Australia, 12,000 miles, or to any part of the British Empire. The collection and delivery of letters steadily improved. There are now about 25,000 post offices and 50,000 pillar and road letter-boxes in the United Kingdom. These are marked on the one-inch Ordnance maps. About 250,000 people are engaged in postal work. In 1914–15 some 3500 million letters, 900 million postcards, 1300 million halfpenny packets, 170 million newspapers and 110 million parcels were delivered in the year—an average of about 125 deliveries per head of population.

The postal system now provides a cheap and sure means of communication. Next to reliability comes *speed*. This has been steadily developed by improving the means of conveyance and delivery. Special mail trains, and mail vans on express trains, which collect, sort, and deliver bags of mail while the trains run at full speed; motor vans, pneumatic tubes, a post office underground electric railway in London and aeroplane mail services to Paris and Brussels (three to four hours) are used. Ten or twelve deliveries a day used to be made in large towns, special messengers deliver express letters. The invention of the telegraph, telephone, submarine cables, wireless telegraphy, and telephony are important improvements in rapid communication.

The Post Office has also become a great *national banking organisation*, used chiefly for small sums. It sends by post office and postal orders about £100,000,000 per annum. It distributes a similar sum in Government Old Age, Army and Navy Pensions and allowances. By issuing licences it collects taxes. Its Savings Bank receives and pays out about £50,000,000 a year. It also issues Government Stock, Life Insurances and Annuities and deals with National Health Insurance. The cost of this vast national postal organisation is about £45,000,000 a year and its net profits average about £5,000,000.

Telegraphy is an important means of communication which has developed rapidly. It uses electricity for signalling. To-day it can print its messages on a narrow strip of paper which unwinds from a large spool. Most large institutions have this tape machine which prints all general news as it comes through. Railways use telegraphy for controlling the traffic on their lines. At first *telegraph companies* were established. The first line for public use (London to Gosport) was opened in 1845, but in 1870 all these telegraph systems were bought by the state for nearly £11,000,000. The overland telegraph was soon followed by the **submarine cable**, South Foreland to France in 1851 and to America 1866, laid by the steamer *Great Eastern*. These linked the British Isles with Europe and with America so intimately that almost instantaneous communication became possible. To-day there are 300,000 miles of submarine cable laid on the bottom of the sea in nearly 3200 cables. Some belong to private companies, chiefly British. They own much the larger half. The rest is state property, mostly shorter lengths. Of these about 11,000 miles belong to the Post Office.

The vital importance to the empire of rapid and secure communication led to the laying of the cable from Vancouver *via* Fanning Island and Fiji to Norfolk Island and thence to New Zealand and Brisbane. This is part of *the all red cable.* The red girdle is completed by cables across the Atlantic to Canada and to Cape Town. From Durban another crosses the Indian Ocean *via* Mauritius and Keeling Island to Perth. (See map, p. 155.) There are six cables direct from Valencia to Newfoundland and Cape Breton Island, and one to New York *via* the Azores. The importance of the cables during the war in organising the support of the empire cannot be estimated.

In times of peace the cables, though relieved by wireless, are still barely able to deal with the traffic. The departure and arrival of every ship is cabled and most foreign transactions of importance involve cablegrams. Press reports make great demands upon them. Most of the messages are sent by code.

The most direct and convenient means of communication is the **telephone,** invented by Bell, an American, 1877, and now in general use both in business and in private houses, though much less so than in some foreign countries. Both the Post Office and the National Telephone Company developed systems. The latter was bought by the Post Office and taken over on 1st January, 1912. The great advantages of the telephone are its cheapness, convenience in time-saving and in permitting *conversations.* Communication is direct and immediate, business matters and private affairs can be settled without third persons. It is possible to telephone to Paris and Brussels, and trunk lines exist between London and the chief towns of the British Isles.

The latest developments are *wireless* telegraphy and telephony which need high and well-equipped stations for sending messages, but require no expensive system of wires or cables.

TELEGRAPH AND TELEPHONE STATISTICS

	Miles of Wire.	Telegraph Offices.		Messages per Annum.	
		Public.	Railway.	Inland.	Foreign.
Telegraph	270,000	14,200	2,500	90,000,000	15,000,000
		Telephones.	In London.	Calls.	Trunk Calls.
Telephone	3,000,000 (2,000,000 are underground)	800,000	275,000	800,000,000	45,000,000

New York has 750,000 telephones. U.S.A. have 14 telephones per 100 population, Canada has 7, Sweden 6.5, Norway 4.5, Great Britain has 2.

EXERCISES

1. Write a short summary showing how the Post Office has assisted national (British) development by facilitating social, economic, Government and foreign affairs.

2. Make comparative tables showing the advantages and disadvantages of (*a*) aerial and underground telegraph wires, (*b*) the telegraph and telephone, (*c*) wired and wireless telegraphy and telephony, (*d*) train, motor van and aerial post.

3. What advantages were claimed for the Imperial penny letter post (1908–19)?

4. Account for the greater use of the telephone in countries like U.S.A., Canada, Norway, Switzerland, Sweden.

CHAPTER XVII

WIRELESS

The nineteenth century brought us the railway (1830) and the telegraph (1837); the twentieth century brought aircraft and wireless. As the telegraph is invaluable in the control of railway trains so wireless makes flying safe and successful. All airships and many aeroplanes carry wireless apparatus.

In 1896 Marconi came to England, demonstrated to Post Office officials in London and took out his first patent. In the next year the first wireless station was set up at the Needles. Progress was rapid. In two years ships and lighthouses used wireless to call for help, and a station was erected at Chelmsford. In 1900 English warships received installations and the high-power station at Poldhu (Cornwall) was begun. Two years later the first wireless message was sent across the Atlantic. A high-power station was erected at Clifden (Galway) which started a public service to America (Glace Bay) in 1907, and in 1910 sent messages to ships 4000 miles by day and 6735 by night. In 1909 the *Post Office* took over the coast stations (except Poldhu and Clifden worked by Marconi).

Meanwhile, wireless telephony was fast developing and Marconi was able to telephone forty-five miles in 1914. The war came and all private wireless stations were closed.

Wireless began to be used for many purposes and emergencies. Explorers in the Antarctic and in Asia used wireless time-signals to determine their longitude. The Eiffel Tower telephoned to U.S.A. (1915) and after a year the exact difference in longitude between Paris and New York was determined by wireless experiments. The work of the broken cable from Oban to Mull, of the cut cables from Dublin, and of the U.S.A. railway telegraph system, smashed by a great blizzard, was done by wireless. English vessels were licensed for wireless, 1916, and a wireless telephone fog-warning was installed by U.S.A. in the Atlantic. Some 3000 vessels and many aircraft carried wireless telephones in 1918; aeroplanes used the 'phone, too In September Carnarvon sent a wireless telephone message to Sydney, Australia (12,000 miles), while San Francisco sent wireless telephone messages to Japan *via* Hawaii.

A public service was now opened from Clifden to Glace Bay and private stations were re-opened in 1919. Sir John Alcock's aeroplane and the airship R. 34 used wireless telephony during their trans-Atlantic flights. In 1920 the Marconi Wireless Telegraph Company at Chelmsford station made great advances in wireless telephony. Concert programmes were heard at St. Johns, Newfoundland (2673 miles), and by ships 1000 miles away. Wireless and land telephones were linked up, also wireless telephone, land lines and aeroplanes. Ships can now be steered by radio (wireless) control at ten or twelve miles' distance. Weather forecasts are circulated by wireless telephony. There are a great many amateur stations.

The war both hindered and stimulated wireless. In particular it directed attention and enterprise south-east to the Continent. Recent important developments in the use of wireless telephony are numerous.

1. *Direction-finding.* Certain coastal stations are used to determine the position of ships at sea. (See Map 41.) It is possible now to detect the direction of the call, and by planning the intersecting direction-lines of, say three stations the bearing of the calling ship, airship, or plane is determined at the station and reported to the ship. This is extremely valuable at night or in foggy weather.

2. *Forecasting* the weather for temporary or permanent operations over a larger or smaller area. Wireless telephony can collect weather reports and distribute forecasts. This is done

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FIG. 41.—CHIEF BRITISH WIRELESS STATIONS

regularly from London and Aberdeen. Such forecasts (see newspapers) are valuable to farmers, pleasure seekers, fishermen, builders, aviators and sailors, etc.

3. *Time signals*, now given daily by certain British and European high-power stations, assist correct time-keeping throughout the Continent and the United Kingdom. This is most important to ships and airships over the sea, in determining longitude, position and speed. Standard time at sea is now possible and important time records can be more exactly kept.

4. *Aviation* leans more and more on wireless telephony: forecasts, reports of weather, wind direction and force and landing conditions are communicated. Aircraft are able to call for information, for landing-lights at night, etc., and to learn their position and direction in bad weather or in night flying. Up to 125 miles the telephone is preferred for this work.

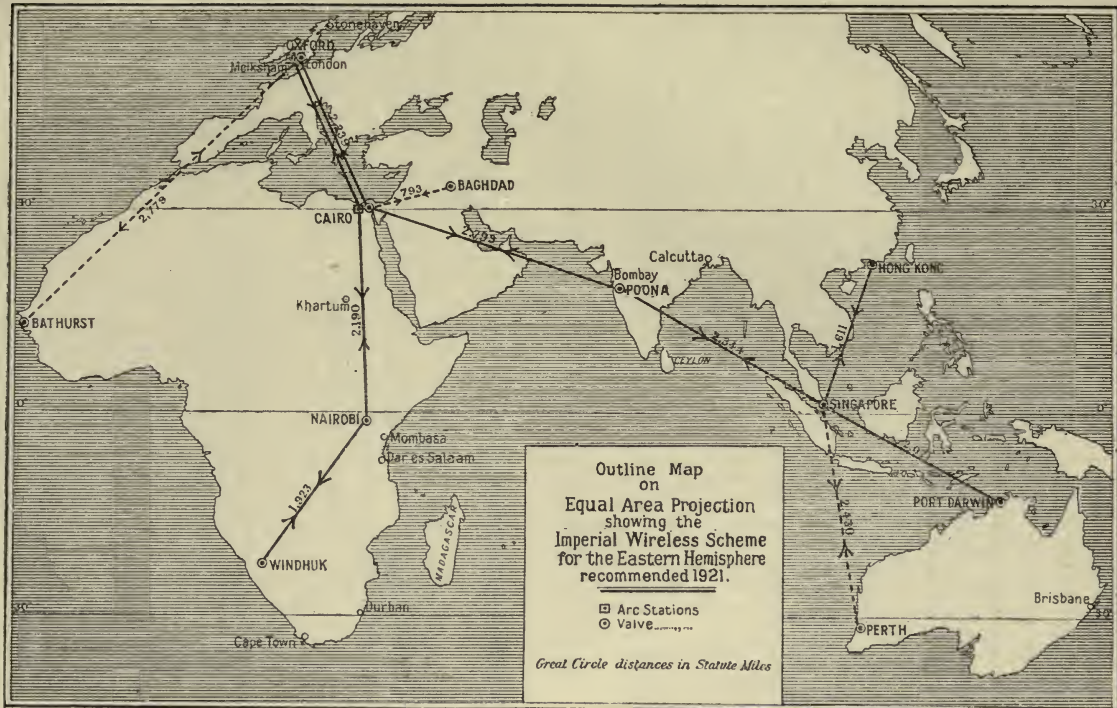
5. It has been found possible to control railway trains by means of telephone, while ships have been steered by wireless waves.

The importance of these new wireless achievements for traffic and communication is not easily over-estimated. Certainty, safety, speed are ensured, risk is minimised, unforeseen difficulties and dangers are removed, thousands of lives and much valuable property have been saved. Regular communication was held with the navy at 1600 miles' distance and with the army in Germany.

A recent report[1] gives details of a great Imperial wireless scheme intended to draw the Empire into closer and more convenient communication, both for defence and for commerce. Some of the world stations communicate at a distance of over 4000 miles and a few over 5000 miles. The map shows the eastward scheme suggested. The Leafield-Cairo service is already provided for. The entire scheme is estimated to cost £1,250,000. It would take two years to build, and have an annual traffic of about 10,000,000 words.

The means of communication, without which industrial,

[1] Imperial Wireless Telegraphy Commission, June 1920.



By permission of H.M. Stationery Office.

THE MAPPA CO., LTD., LONDON

FIG. 42.—HIGH-POWER IMPERIAL WIRELESS STATIONS SUGGESTED FOR THE ROUTE.

commercial and private life could not develop, seem to be in competition. In reality they support and assist one another. The post uses the railway, and the railway the post. Telegraph and telephone enable railways to be worked safely and rapidly. Goods sold by telephone are conveyed by rail. The tram, bus and rail feed each other. As travel becomes cheaper and easier, it becomes more common. The building up and interworking of these means of communication have made the development of agricultural, mining and manufacturing industries possible. They facilitate both production and distribution. They are not only the means of trade and commerce and of all transport. They are as essential to the nations of the world as speaking and walking are to individuals. They are the channels of domestic, national and international intercourse and make human life rich and varied and freer from physical limitations.

WORLD'S WIRELESS STATIONS, 1ST JANUARY, 1920

World's Stations.	Approx. No.	Stations of			
		First Rank.		Second and Third Rank.	Aerodromes.
		British.	Foreign.	British.	British.
Coast,	725	Carnarvon	Lyons	Ballybunion	Croydon
Ship,	5,820	Clifden	Eiffel Tower	Horsea	Lympne
Inter-nat'al.	80	Leafield	Rome	Poldhu	Writtle
		Glace Bay (Newfoundland)	Nauen (Germany)	Aberdeen	Castle Bromwich
			Kahuku (Hawaii)	Cleethorpes	Dewsbury
Total	6,625			Whitehall	Renfrew

Each station has its own call signal, a combination of letters allotted by the International Wireless Commission at Berne. The United Kingdom has about 100 important stations for sea and continental communication (see map, p. 169).

CHAPTER XVIII

MOTIVE POWER—ITS SOURCES AND APPLICATION

The development of the industries, occupations, communications, population and wealth of the British Isles and of the Empire rest upon the steady growth of power—mental, moral, and physical. Here **physical power** is our concern—*prime movers*, that get work done. The earliest of these were *human bone and muscle.* The arms and legs of innumerable men, women, and children laid the foundations of the world's industries and still hold a prominent place not only in the occupations of uncivilised or backward peoples, but in the highly organised industries of Britain. The early Britons, however, had learned to use horses in fighting and oxen in ploughing, and these habits persist still though in less degree.

Some of **Nature's forces** were long ago discovered and yoked to man's machines. On sea the *wind* enabled him to encircle the world, to discover and colonise remote lands, to exploit the resources of far-away countries. On land the *running water* was a more regular, easily controlled and powerful form of energy. Domesday Book records a watermill on most manors. It ground the peasants' corn and brought income to the lord who owned it. Some of these mills still exist and are in use. They were the forerunners of modern "mills" of all kinds. Windmills were in use about the tenth century, but their era in England came with the Dutch influence in agriculture and in fen drainage and for a time at least is past. All through the Middle Ages man and beast, wind and water, did the work of cultivation, of grinding corn, and of transport. In the peaceful but toilsome work of the farm the beast was chiefly the ox. Better roads, better breeds of horses and better vehicles began to displace the slow ox in the seventeenth century. The speedier and more graceful horse encouraged riding and driving, carriage and coach transport. Better harness and carts, simple agricultural machinery, more scientific methods of farming and a speeding up of all processes *made the horse king* of the land. But Sussex oxen still ploughed in 1901 and the war may have brought them back on some few farms.

The ancient water, flour and saw mills had a long period of usefulness amounting almost to indispensability. Before they were eclipsed by steam there was a sudden extension of their use in the rapidly growing textile industries. The epoch-making inventions of Arkwright, Hargreaves and Crompton in the late eighteenth century called for power. The use of water power was familiar and in the deep water-valleys of the southern Pennines were built the new cotton mills on the banks of swift streams.

But this new era of water power was short. In the very year (1769) in which Arkwright patented his "water-frame" for spinning, Watts patented his *steam-engine*. A great engine-works was built at Birmingham and by 1780 forty engines were in use, chiefly pumping in mines. The rotary engine was next invented and improved for use in flour mills and other works, and in 1785 was first used in a cotton mill. The age of steam had arrived. People went "steam-mad." Growing industries had now not only new engines but a new enthusiasm behind them and developed rapidly. Wherever coal could be had engines were asked for. But coal needed transport, hence came canals—a new field for horse-draught which still remains—and later steamships (1820) and steam railways (1830). (Experimental steamboats and locomotives were running in 1801.)

So *coal became king*—not only of factory but of the railroad and the sea. Watts's invention made the industrial revolution possible. It was in effect a steam revolution, for water power was far too limited to drive the new machinery and would not have provided the master-key—rapid, cheap transport on land and sea.

Coal is a natural storehouse of energy (heat) and steam is a convenient though wasteful way of applying this energy to the machine by means of the engine. But it was long before coal was readily and cheaply obtainable in every part. On the southern and eastern hills were built solid and stately brick windmills with movable heads, for grinding corn. In the Fens innumerable wooden mills threw the water from the drains over the banks into sluggish rivers and so converted the great swamp into the most fertile wheat and potato land in Europe. In the last thirty years great numbers of windmills here disappeared, superseded by steam corn-mills and pumping machinery—more efficient, but less picturesque.

The nineteenth century was the age of steam, but before its close new inventions had already heralded a new era. The hold of steam, however, has been considerably strengthened by Parsons' turbine (1884), which sprays steam direct on to a revolving drum instead of allowing it to expand in a cylinder. It is a much simpler, cheaper, smaller and lighter machine than an engine of the same horse-power. Moreover, while the steam-engine runs slowly—up to 350 revolutions per minute, a turbine will make 30,000 and will develop great power. Most passenger vessels and all warships use turbines—weight and space are important there—and many electric stations drive the high-speed dynamos by this means.

To drive engines with steam is a wasteful way of using the energy in coal. The coal is not entirely burned, much escapes in the smoke which is injurious to plant and animal. (The 17,000,000 tons of coal burnt every year in London deposit 165,000 tons of soot in the streets, houses and gardens.) A great deal of the heat produces no steam. The steam power itself is not completely used in most engines, and the moving parts of the engines are numerous, heavy, and wasteful in energy. About the year 1800 coal began to be turned into gas and coke, etc. These products were first used for heating and lighting. But experiments were made with gas engines in which the gas is exploded in a cylinder instead of using steam. Now that most towns have a gas supply these gas engines are much used in all kinds of industries where power is wanted.

In general one invention grows out of another. The steam-engine suggested the gas engine, the latter led to the petrol engine in which a spirit which easily vaporises takes the place of gas. It is supplied to the engine as a liquid but enters the cylinder as a gas, mixed with air ready to burn with a violent explosion. This development has given us the twentieth-century *internal-combustion petrol engine* ranging from the small one-horse-power cycle attachment to the airship combinations producing thousands of horse-power. These engines use a new fuel—spirit or petrol—distilled from oil or coal and consumed *in the cylinder* and not under a boiler. It has revolutionised road traffic and transport, almost driven the horse from the streets and the road and greatly changed methods of road-mending and surfacing. It has brought fast and heavy vehicles (lorries) on to the road and made them compete with the railway in speed and cheapness. It is estimated that there are 750,000 motor vehicles on the road.

A further development of the engine that uses the heat of its fuel in an explosion and not in raising steam is the *Diesel* engine, invented by a German engineer a few years ago and now in common use in ships and factories. It is a heavy engine and consumes thick, crude oils, and so costs much less for fuel than the petrol engine. Each type of engine has its appropriate uses. Steam-engines need much water and coal, hence they are stationary or are in use in ships and rail locomotives, where the weight of coal is less serious. Petrol is a concentrated and light fuel suitable for road and air traffic, where weight must be kept down. The Diesel engine is suitable for shipping and stationary work, but is too heavy for rapid and light traffic. The gas engine is tied to its gas supply, whose bulk is too great for transport work.

In 1867 the *dynamo* was invented. This gave man the use of another natural force—electricity. The use of it for power, however, belongs chiefly to the twentieth century. The machines for controlling and applying it are quite unlike the engine, and had to be invented, not adapted. Electric power has certain characteristics in common with other forms. Like gas, it is not conveniently stored and carried on the road—accumulators are very heavy. It can, however, be readily conveyed by overhead or underground wires. Hence it is much used for tram and railway traffic, where the rails serve the double purpose of carrying easily the heavy machine and conveying current. Electric power admits of rapid and complete control. The electric motor quickly develops great speed and great power, and is therefore more convenient than any other kind of prime mover. Hence its use on short-run rail and tramways, where stopping and starting must be frequent and rapid. In the factory, too, its flexibility is most valuable. A powerful engine and shafting often runs at great waste because the power is not wanted all the time on all machines. With electric current laid on each machine, each workman has a separate motor under instant control and supplying speed and power within the necessary limits.

But electric current has to be "made," and therefore some other source of power—water, steam, gas, oil—is necessary. Some of this power is lost in producing electric current. The advantage gained is the greater ease of control and distribution. This advantage, in the case of water, is often everything. Water power is apt to be in inaccessible places—mountains, valleys, or gorges, vast waterfalls. Niagara can supply 2,000,000 horse-power in electric current to towns many miles away, and could supply 4,000,000. The water power could not conveniently be used by mills built on its banks. The electric current is carried instantly and cheaply to those places where materials are easily collected. Great cost of transport is thus saved. This restores or, rather, vastly increases the value of water power, which can now be easily and cheaply transmitted in the form of electricity to distant towns for lighting and power purposes. But the initial cost of setting up electrical plant by the side of falling water often in remote spots is great.

In England and Ireland there is much less water power than in Scotland and Wales. But England is said to possess one million horse-power of water power unused. The water is commonly used for canals and rivers, town supplies and industrial purposes, but the use of the power now wasted would not prevent the use of the water afterwards. The Water Power Resources Committee set up by the Board of Trade estimates that England and Wales would produce about ten horse-power continuous per square mile, or about half a million horse-power in all. This total can be vastly increased by using the tidal waters, especially in rivers where a great quantity of water is raised a considerable height. The Severn is perhaps the best English tidal river for the purpose. The scheme to harness the Severn tides proposes to build a great barrage about 2¼ miles long across the Severn near the line of the present tunnel. It estimates that the water turbines would produce half a million electric horse-power per day through the return of the imprisoned tidal waters. Towns within a great radius (say 80 miles) would be supplied with very cheap current (½d. per unit), and various factories would be built along the banks. Bristol opposes the scheme (estimated to cost £30,000,000) on the ground that it would silt up the Avon and Avonmouth docks. (*Cf.* Fig. 43 opposite.)

Most wind and water resources are irregular in supply. Wind cannot be stored, and storing electricity is costly; but water storage, given suitably-placed land, is easy and cheap. Hence the Severn scheme provides for a vast storage reservoir to ensure continuous supplies of electric current. Similarly, the plan to revive the use of wind power by the means of giant wind turbines on high land or cliffs suggests that wind turbines (400 feet high and of 25,000 horse-power each) should pump water into reservoirs, and so, though themselves intermittent in working, store a continuous supply of water power and hence electrical current.

FIG. 43.—THE SEVERN BARRAGE SCHEME

Populous areas which might be supplied with Electric Power and Light.

The intervention of science and electricity may thus use again wind and water power, resources that are widespread, costless and inexhaustible. The rapidly increasing cost of coal and oil, and of their transport and storage, is stimulating those who would exploit the natural forces as against natural fuels. The initial outlay on such schemes is great, and meanwhile fuel holds the field as the chief source of energy.

The supremacy of coal is, however, threatened by the competition of oil, which is clean to handle and burn, and easily conveyed and stored. The great coal strike of 1921 gave a great impetus to the use of oil. Oil was already the sole fuel in the Royal Navy, and oil stores were rapidly accumulated at naval stations throughout the world. Many ships were being built for oil fuel, and others, notably the giant *Aquitania*, converted their furnaces for oil. (On her first oil trip to America she gained twenty-nine hours on the *Mauretania*—a sister but formerly much faster coal-fed ship.) A great many factories and the tramways of numerous towns were run on oil. The main railways converted coal-fired to oil-fed locomotives, and saved both cost and labour. The coal industry suffered a severe blow; yet not only English and Scottish, but all oil-fields must prove productive if the changes are to be far-reaching and lasting. At present coal costs much to get but less to convey, whereas the transport of oil from overseas in specially built oil-tankers adds much to its cost.

The normal British coal output is about 275,000,000 tons, or less than 25 per cent. of the world supply. Of this we consume nearly 200,000,000. The British Empire produces only about 2½ per cent. of the world's oil (550,000,000 barrels of 40 gallons). Assuming 4 barrels equal one ton of coal in heat value, the world's oil output is less than half the British coal production. Moreover, very much may be done by the more economical carbonisation of coal and distillation of its oils and other by-products.

Wind and water are free, and the electricity produced is easily distributed. The Norwegians have great water-power resource, and propose to distribute hydro-electric power to Britain *by wireless!* The control of 1,000,000 horse-power of electric current is possible with 50 men, but to raise coal enough to generate it requires 25,000 men.

QUESTIONS

1. Prove or disprove the truth of the first statement of this chapter.

2. If the British coal resources are 180,000 million tons, how long will they last at the present rate of coal raising? Which possible developments are likely to affect your estimate either way?

3. What would be the advantages of building great (electric) power stations at the pithead, and how would the present, *e.g.* London, power stations be affected?

4. Why is electric current sold more cheaply as a power supply than as a lighting supply?

5. What different kinds of turbines are mentioned in this chapter? Mention some of their advantages over the cylinder engines.

CHAPTER XIX

POPULATION—OCCUPATIONS AND TOWN SITES

A GLANCE at Table I. shows that the British population has steadily grown (except in Ireland), but most rapidly during the twentieth century. Economists tell us that *population is closely controlled by food supply*, each person requiring on an average one quarter (eight bushels) of corn per annum. Agriculture improved enormously in the eighteenth century, and there we see the first big rise in population. We exported corn till 1792. After that industry claimed so many workers and so much land that our corn production has fallen to about one-third of our needs. Our industries, however, enable us to buy the food produced elsewhere. Our prosperity was so great that the population increased in 100 years 3½ times in England and nearly 3 times in Scotland. Ireland kept pace to 1841, since when internal trouble and rapid emigration have caused the numbers to decline. In Europe, England is second only to Belgium (650) in the number of people per square mile. Before the war the United Kingdom lost 200,000 to 300,000 annually by excess of emigration over immigration.

TABLE I

POPULATION OF ENGLAND

Estimated to 1700. By Census on and after 1801 (First Census)

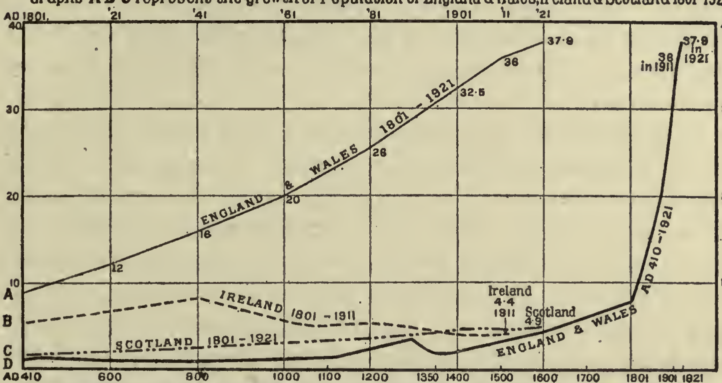
Year.	Approx. Pop.	Notes.
A.D. 410	1,000,000	End of the Roman Period.
1100	1,500,000	Doomsday Book gives 25 to 35 per sq. mile (except East Anglia =63, due to greater fertility of the soil).
1300	3,500,000	
1400	2,500,000	The Black Death (1348) had carried off nearly half.
1500	3,000,000	There was rapid growth under the Tudors.
1600	4,500,000	Possibly lower.
1700	6,000,000	Estimated on registered Births and Deaths.

CENSUS FIGURES
(To nearest thousand)

	England and Wales.	Per Square Mile.	Scotland.	Per Square Mile.	Ireland.	Per Square Mile.
1801 .	8,893,000	152	1,608,000	54	5,395,000	166
1821 .	12,000,000	206	2,092,000	70	6,802,000	209
1841 .	15,914,000	273	2,620,000	88	8,175,000	251
1861 .	20,066,000	344	3,062,000	100	5,799,000	178
1881 .	25,974,000	445	3,736,000	125	5,175,000	159
1901 .	32,528,000	558	4,472,000	150	4,459,000	137
1911 .	36,070,000	618	4,761,000	160	4,390,000	135
1921 .	37,885,000	649	4,882,000	164		

N.B.—Wales only: 1801, 542,000; 1901, 1,387,000; 1911, 1,647,000; 1921, 2,207,000.

Graphs A·B·C represent the growth of Population of England & Wales, Ireland & Scotland 1801-1921



Graph D shows the growth of the Population of England & Wales from 410 - 1921.

FIG. 44.—GRAPHS SHOWING THE GROWTH OF POPULATION

As food supply determines population, so "getting a living" largely decides *where people live*. The reasons for deciding where to live have changed frequently and greatly. It is important to understand them. The ancient Britons lived on the tops of the hills away from the marshy, forest-covered valley in great clearings less liable to sudden attack and suitable for growing corn and rearing cattle. Later they occupied riverside clearings.

In England most Keltic names became Roman. The commonest contain *dwr* (water) as in Dover and Dorchester.

The Romans were highly civilised. They built great camps at important points, frequently on Keltic river sites, and made good roads by which supplies could be brought up. Great numbers of British men and women were required to serve their large armies, and the camps grew into large towns, most of which, though neglected by the Saxons, have become the cores of our best known towns. (See map, p. 109.)

The Saxons preferred the lowlands. They cleared great spaces in the forests near rivers and springs. Study any Ordnance map (*e.g.* Cambridge, p. 186), and notice how the villages lie along valleys at the foot of chalk hills where springs and streams issue. *A good water supply is very important*—to-day it is controlled by the town authorities and is often brought many miles (*e.g.* to London, Birmingham, Liverpool, Manchester, Glasgow, Sheffield, etc.).

Later, *personal safety* again became a chief factor. The Danes attacked defenceless villages and towns. Strong places became important centres of life, and people gathered there for safety or to carry on their calling. The Danes themselves strengthened Saxon and built Danish towns in the Midlands, near the Anglo-Saxon frontier. Thus Derby, Leicester, Nottingham, Stamford and Lincoln became famous Danish boroughs—strongholds, and later great trading towns. Towns founded by the Danes are commonly on the northern, Scottish and Irish coasts. They are often indicated by *by* (town), Whitby; *ford* (fjord), Wexford; *garth* (enclosure), Fishguard; *kirk* (church); *ness* (cape); *thorpe* (village); and *wick* (creek). Other Danish towns are Dublin, Waterford and Limerick.

The Normans added little to the population of England. They, like the Romans, established themselves as rulers and erected castles to overawe the people. Being a cultured people accustomed to town life, they seized the towns, fortified and strengthened them, and built their castles, churches and abbeys there, usually without changing the name. Where necessary, they built new strongholds. Newcastle-on-Tyne was built by William I. at the end of the Roman Wall. Castle towns occur elsewhere, as Castletown, Barnard Castle (Yorks), Castle Rising (Norfolk), Castle Douglas (Scotland), Castleton (Ireland). Most Roman towns thus gained a castle and an abbey or monastery, the church of which, in many cases, afterwards became a cathedral (*cf.* maps, p. 109 and p. 204).

It appears, then, that apart from the new sites of the last century, most of the towns and villages in England were set up by the early English. The endings "*ton*" and "*worth*" (Kenilworth) indicate a stockade—a small settlement fenced and strengthened against attack. Frequently the settlement was called a *ham* (home), as Teversham. The hamlet or little village was always near water, often at a shallow part of the river. It was then called *ford*, as Duxford. A stronghold on a hill was called a *burgh* (bury, borough)—*i.e.* a hiding place (Wandlebury). In many low or marshy valleys were dry places like low islands. These were called *ait*, *ayot*, and *ey*, and are found in the Thames valley (Chiswick Ait), near the sea (Sheppey) and round the Fens (Ely). Other Saxon names include *ash* (tree); *burn* (stream); *field*, *hurst* (forest); *law or low* (hill); *stan* (stone); *stead*, a place (*cf.* map, p. 186).

As the population increased and the country developed, travel became more common, bridges were built over the deeper rivers (often by monks or religious people), roads came from various directions to the bridge; inns were built there, the smith and wheelwright found it a good centre; it became a place for the sale or exchange of produce, cattle, horses, sheep, of linen and woollen cloth, metal wares and valuables. Thus a market developed, often called a *cheap* (Cheapside, Chipping Barnet), and later *market*, *e.g.* Market Deeping (Lincs.), Market Bosworth; a church was built for the growing population, stalls were set up, and later fairs would be held, especially in the autumn, when the products of farm, loom and workshop were ready for sale or exchange.

Thus arose, for example, *Cambridge*. It is true the Roman roads run through it, that a Roman station (Grantchester) is near, that it had a strong Norman castle, but these mark the early appreciation of this important position.[1] It lies at the foot of the chalk ridge (south and south-east) which, bounded south by a great forest and north by the vast swamp of the Fens, was

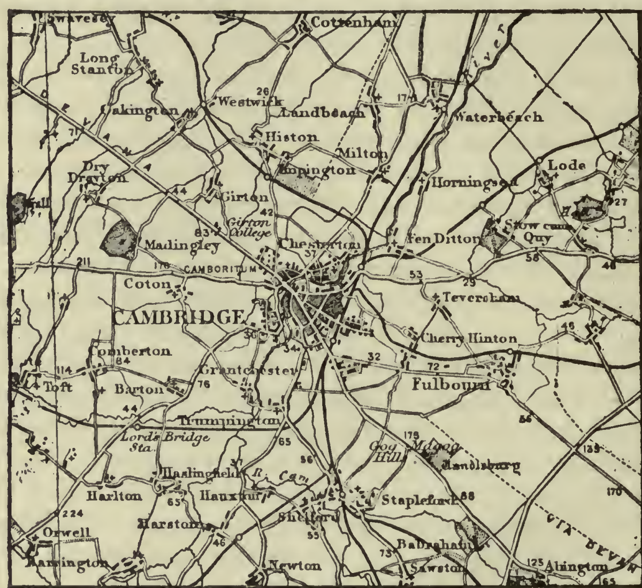


FIG. 45.—ENVIRONS OF CAMBRIDGE

the great "highway" in and out of East Anglia, England's richest corn land. From it in Roman times ran a canal to the Trent to carry corn to Roman soldiers at York. Up the river came ships over the sluggish waters; notice Landbeach and Waterbeach and Westwick (west creek or harbour). It became a great *entrepôt* and had one of the biggest fairs (Stourbridge Fair) of the Middle Ages, and attracted traders from West and North-West Europe. Thus, too, it became a great exchange of

[1] *Cf.* map, p. 260.

learning. Wandering scholars and teachers and sellers of books (manuscripts) met in those busy weeks to teach and learn, to discuss and dispute. From these small beginnings grew a great university of world-wide repute.

To-day the fair is unimportant, but the market-place is still crowded each Saturday, farmers throng its Corn Exchange in the autumn; it has steam flour mills and a great cattle market, and a population of nearly 60,000. Notice on the map the many roads radiating from the town—some Roman, but most Saxon lanes, a thousand years old—notice, too, the four railways converging from the south and west and diverging in four directions north and east. Trace these further on your atlas.

Take a map and notice the network of towns scattered over the country, *-ford*, *-bridge*, *-ton*, *-bury*, and *-ham* towns—all Saxon and all distant about six to twelve miles from each other. These are the *market towns* of the middle and modern ages, the trading centres of the country. There every need could be met, every friend and relative greeted, every product sold or exchanged. To market and back was a day's journey to ride or drive. In the nineteenth century banks, wholesale and retail stores, railway stations and schools were built there. To-day many of the smaller market towns are falling out of use. The post, railways, and motor have opened up other markets and supplies, and country folk go further afield; the bigger towns—Bedford, Cambridge, Ely, Norwich, Lynn—still grow, the smaller ones decay—unless some new purpose, some new occupation or industry is given them. To-day there are in England some 340 market towns (population 3000 to 30,000) which are supported by rural products and trade; most lie south of the Midland coalfields.

For 1000 years or more—to the end of the eighteenth century—the distribution of population was on a basis of *agriculture* and *home industry*. The great revival of agriculture in the eighteenth century brought prosperity and greatly strengthened the hold of the land on the people. The improvement of roads and the establishment of local banks, insurance offices, corn exchanges and cattle markets increased the traffic of the country towns. Every village and town had its craftsmen—smiths, carpenters, wheelwrights, builders and painters, harness-makers—and purveyors—butchers, bakers, shopkeepers, innkeepers and other necessary tradesfolk. Each community was self-sufficient with the support of the wholesalers and large retailers of the nearest country town. The richest and most densely populated lands were east of a line from the Wash to Southampton. Here were the chief industries and the capital city. Iron-smelting with wood-charcoal was a Wealden industry. The great woollen districts lay in East Anglia and south of the Thames, centred around Norwich, Canterbury, Guildford, Newbury, Bradford (Wilts), Trowbridge, Stroud (Glos.). The fine churches, guildhalls and mansions of these old towns were built by the wealthy wool merchants.

The eighteenth century was a time of transition from the agricultural to the industrial basis of the distribution of people. Industry was developing rapidly, but was still closely dependent on agriculture—on its corn (for milling), hides (boots and saddlery), wool (cloth-making), timber (building, coach and wheel work), straw (plaiting). A flourishing agriculture needed tools and machinery; iron was still being smelted from the ironstone of the south and east. Banbury, Bedford, Ipswich, Norwich, Lynn and Lincoln became famous for farm implements and engines. Thus country towns developed a new purpose and importance and grew apace. The industrial age was beginning in the late eighteenth century. People were moving to the towns—craftsmen were getting fewer in the villages, farming implements displaced many labourers. Coal and iron did not yet dominate occupation and industries, but many towns in the Midlands and North were rapidly developing their resources and industries. The Black Country, the Potteries, the woollen and cotton towns were being established on coalfields. The invention of the steam engine and of the cotton and woollen machinery, and the cutting of canals greatly accelerated these developments. Birmingham (74,000 in 1801) was already famous for its blacksmithing, metal working and engine making. It has now a population of 910,000.

A great change in the organisation and control of industry had been going on for centuries. Craftsmen were ceasing to be independent workers who bought their own material, worked on it and sold their produce. In the great woollen industry the capitalist early appears as employer. In 1339 Thomas Blanket, of Bristol, set up looms and hired workmen. He supplied everything, paid wages for work and sold the cloth. This plan spread. In Tudor times much dissatisfaction was felt among the weavers, and an Act was passed to prevent the spread of the system in the woollen towns of the south and east. Capitalism and the employment system, however, became inevitable and their existence made rapid adoption of machinery and steam engines possible when these were invented and transport was provided.

Thus came *The Industrial Revolution*. It not only changed the method and means of industry, it changed the place and mode of life of millions of people in the British Isles. When water power was applied to weaving, a great change was begun. In the early eighteenth century the woollen industry was found throughout the British Isles, linen was made in Scotland, Ulster, and Yorkshire, but cotton was waiting for the invention of better machinery. Seaborne coal was little used for industry, and the steam-engine as we know it had not been invented. From 1760 a rapid succession of inventions came into use. Water power was used (hence cotton "mills"). Factories were built in the south-west where there are streams, at Bradford, Trowbridge, Stroud, etc., but the mountain streams of Yorkshire and Lancashire were better suited, and mills were quickly built along their banks.

Then came Watts's steam engine, made from 1775 in Birmingham. Coal was wanted, mines were rapidly developed. Iron was wanted for machinery and engines. The iron industry passed entirely from the South to the iron and coalfields in the Midlands and North. Transport was wanted. Canals, and later railways, came to carry coal to the furnaces, iron to the shops, goods to and from the ports. But workers were wanted also; they had streamed in steadily from the waterless and coalless West and South-east to the Midlands and the North. Towns like mushrooms sprang up round the factories. In fifty years the balance of population had changed, the land was left for the "mill," the home industry for the factory, the scattered cottages, pure air, and gardens of the villages for the smoke and dirt, the crowded slums, and the long hours of factory towns. It was a revolution in life conditions. (*Cf.* map opposite.)

In 1801 nearly three-quarters (72.4 per cent.) of the people of the United Kingdom lived in the country, in 1851 one-half; but now four-fifths live in towns. In 1911 over 250,000 persons were living four or more in one room.

TABLE II

(*a*) Population in Town and Country. (*b*) Number of men, women and children (ten years and over) engaged in the occupation stated (1911).

	Urban.	Rural.	Industrial.	Agriculture and Fishing.	Commercial.	Professional.
England & Wales .	78%	22%	9,500,000	1,260,000	2,215,000	715,000
Scotland .	75%	25%	1,226,000	227,000	283,000	82,000
Ireland .	33%	67%	640,000	876,000	98,000	131,000

N.B.—Compare the numbers given with the total populations (Table I.).

Employers had not yet learned to care for the life conditions of the worker. Industrial and commercial expansion monopolised attention. The new industrial areas often became bespattered with ugly, overcrowded, insanitary and demoralising towns. Factories, workshops, and dwellings were huddled together in

FIG. 46.—THE DISTRIBUTION OF POPULATION IN GREAT BRITAIN AND IRELAND

one unwholesome jungle where poverty and riches, unemployment of men and sweating of women and young children later became rampant. Thus in a generation was the modern England born with a newness about occupations and methods and a freedom from regulating custom and tradition which favoured fierce competition and exploiting workers. Villages grew suddenly into great towns, ports doubled and trebled their populations in a few years, the people of Great Britain increased three-fold in a century. Towns like Cardiff, Birmingham, Stoke-on-Trent, Manchester, Bradford, and Glasgow became centres of vast industrial areas in which smaller towns tend to agglomerate into a continuous maze of streets having a radius of five to ten miles. The **density** of population in *England* ranges from 40 per 100 acres in the southern counties and Wales to 90 in the North Midlands, 125 in the northern counties, and 2500 in Middlesex and London County.

Scotland has in one great industrial area two-thirds of its population. Glasgow has over a million and Edinburgh nearly 340,000 people. The rural districts are great and have a density of 4 to 11 (Argyll has 4) per 100 acres. There are great stretches of moorland (forest) practically without population. (*Cf.* map, p. 191.)

Ireland has no densely populated areas except two towns—Dublin, 310,000, or with suburbs 410,000; Belfast, 400,000. Cork, 80,000; Londonderry, 40,000; Limerick, 40,000, and Waterford, 30,000, come next. All are ports. There are about a hundred towns having from 2000 to 15,000 people. The density in Ulster is 20 and in the other provinces 13 per 100 acres.

The three capitals, not being in the midst of great industrial areas but thriving steadily on their commercial and metropolitan traffic, have grown more continuously and with less outstanding evils. They have their slums in the heart and their suburbs on the outskirts. As seats of government and of culture they are the home of brain-workers, but the wants of a large and mixed population and the trade of a port encourage industries of all kinds.

Every great industrial town has suffered the evils of rapid and undirected growth to some extent, but many, and especially the older foundations, have added something of glory to prosperity. Some towns, like Birmingham, Manchester, Liverpool, Glasgow and Belfast, have magnificent public buildings and fine centres of culture—cathedrals and churches, universities and schools, libraries and picture galleries, museums and theatres. Many have laid out broad streets and beautiful parks and are removing, often at great cost, mistakes of hasty development.

Many ancient towns came within the influence of the new industries and have been carried to high levels of wealth and importance. A good example is *Leicester* on the Soar (formerly the Leire). It was probably a Celtic, certainly a Roman, settlement (Ratæ) on a river-road crossing. As a Danish border fortress and a Norman castle town it was strongly fortified. Wolsey died in its abbey. Since the days of Simon de Montfort, Earl of Leicester, it has been prominent in the struggle for liberty.

Situated at the heart of England in a country rich in corn, cattle and sheep, it early became a great centre of trade, especially in wool. In Stuart times it had a population of about 5000. When industrial revolution came, Leicester's road system, wool supplies, coalfield (Charnwood), and trade enabled her to take full advantage of the new movement. An early railway was built to bring the coal to Leicester, and the town is now a great railway centre. Its special wool industry is hosiery and underwear, but along with this go cotton and silk manufactures. From its grazing lands it has developed leather and boot-making; it has also important iron and engineering works. Its population is now about 248,000.

Other towns and areas grew quite as rapidly. Lancashire, possessing coal, iron, a unique climate and Liverpool as port, has monopolised the cotton industry. Liverpool's population, 83,000 in 1801, has multiplied nearly ten times. Mountain wool and mountain streams for washing and working it encouraged the woollen industry in the West Riding; later, the coal and iron supplies placed the district easily first in this industry. Similarly the flax and pure water of Ulster favoured the linen trade of Belfast, which has kept its lead, although coal and iron have to be brought from Ayr, Cumberland and Furness. The Glasgow district, with its coal, iron and wool supplies and its convenient cotton ports, has developed great shipbuilding, cotton and woollen industries. The Tyne ports have grown up on coal exports and shipbuilding. The Pottery towns have their coal-field and supplies of coarse clay, but bring in by canal and rail salt from Cheshire for glazing; limestone (Derbyshire), flint, bones, and (from Cornwall) china clay (kaolin) are brought in to make porcelain. The Potteries became world-famous through the genius and enterprise of Wedgwood and his followers.

As new processes are invented industries arise often on new sites. Thus Middlesbrough has grown from a single farmhouse in 1830 to a town of 135,000 on a new method of smelting iron. Great industries have also been built up on imported materials. The use of steamships has stimulated this, and factories are often found in the ports where the raw materials are landed. Thus the (western) ports have great flour mills to deal with the imported wheat. Biscuit factories have grown up near by. The sugar refineries, tobacco and cocoa works of London, Bristol, Liverpool and Glasgow date back to the earlier trade with America. Imports have often revived or strengthened established industries: wheat goes to Reading, flax to Ulster, and (with jute and hemp for sackcloth and rope) to Forfar and Fife. Wood pulp and esparto grass now largely support the paper mills of Kent and Midlothian. Even iron ore is imported in large quantities from Spain and Sweden to South Wales, Cumberland, and the Tyne and Tees works.

TABLE III

	1700	1801	1901	1921	
County Towns					
Norwich	30	37	114	121	Agriculture, mustard works, boots and shoes
York	10	16	78	84	Agriculture, chocolate works
Exeter	10	17	54	60	Agriculture, lace, gloves
Worcester	8	11	47	49	Agriculture, fruit, china
Shrewsbury	7	15	29	31	Agriculture, public school
Canterbury	—	9	25	24	Agriculture, cathedral
Gloucester	5	8	48	51	Agriculture, cathedral
Ports					
London County	500	865	4,536	4,483	World business centre and port
Greater London	—	—	6,581	7,476	
Bristol	29	69	339	377	Tobacco, sugar, cocoa, steel, shipbuilding works
Glasgow	17	77	776	1,025	Cotton, woollens, spirits, shipbuilding works
Liverpool	4	78	704	803	Does about one-third English trade, cotton
Hull	—	29	240	287	Woollens, cutlery, coal
Cardiff	—	2	164	200	Coal, copper works
Industrial Towns					
Nottingham	8	29	247	263	Agriculture, lace, curtains, hosiery
Leeds	7	53	436	458	Woollens, leather, linen, ropes, machinery
Manchester	6	84	645	730	Cotton, woollens, machinery, chemicals
Derby	4	11	115	130	Railway works, silk, porcelain, boots
Birmingham	3.8	74	759	919	Jewellery, machinery, arms and ammunition, glass, plating, cycles
Sheffield	2	31	411	491	Heavy steel, cutlery, instruments, machinery
Counties					
Lancashire	166	673	4,768	4,928	Cottons, woollens, chemicals, glass, machinery
Glamorgan	—	71	860	1,253	Coal, iron, copper and tin
Lanark	—	—	1,340	1,750	Steel, shipbuilding, cotton woollens, spirits
Antrim and Belfast Town	—	—	545	610	Shipbuilding, linen, spirits

NOTES ON TABLE III

1. Table III. shows groups of typical centres of population and their growth during the eighteenth (Agricultural), nineteenth (Industrial) and twentieth centuries. The population is given in thousands, *e.g.* Norwich has 121,000 people.

2. The county towns except Norwich (once the biggest woollen manufacturing city), Exeter and Canterbury are on the fringe of great industrial areas. All except Shrewsbury are cathedral cities.

3. All the ports and industrial towns in the table except Hull and Derby have universities or university colleges.

4. The rapid growth of the larger towns is due in part to absorbing outlying towns and villages when boundaries were increased.

EXERCISES

1. Make a list of towns ending in caster, cester, chester, and give eight other well-known Roman towns (*cf.* map, p. 109).

2. What can we learn of their origin from the names of the following towns: Whitby, Chislehurst, Market Harborough, Bath, Norwich, Battle Abbey, Bury St. Edmunds?

3. Insert on a map the chief inland (river) ports formerly in use, and show the seaports which now take their place. What effect has the change had upon the population of both?

4. What evidence remains of the former wool industries in the towns named on p. 188.

5. Compare the average rate of growth for England (Table I.) with that of the towns above. (Table III.)

6. Draw a graph for each group of towns showing the growth of each town separately. Find the average growth for each of the first three groups; show the three averages in a graph.

7. Account for the less rapid growth of Nottingham and Derby in the eighteenth century.

Modern tendencies in occupations, distribution and town sites.— Enough has been said to show how industry has dominated British occupations and homes. Lacking well-developed transport (rail, canal and steamship), it was inevitable that industries dealing with vast quantities of raw materials should be planted at the source of main supply (coal and iron).

Improved transport, however, is rapidly changing many conditions of industry and life, and is emptying the cores of our large towns or reducing them to slums. The *City of London* had a night (resident) population of 27,000 in 1901, nearly 20,000 in 1911, and less than 14,000 in 1921. The day population, 1911, was 364,000. Houses have become offices, shops, stores, etc.

The inner boroughs, too, are being deserted by those who can now live in the outer suburbs in a fifty-mile radius. Thus many well-built houses have become slums and are let in one-room tenements. The same process is seen in every large industrial town. A fringe of modern dwellings is built on the outskirts often in the form of garden villages.

This is part of the great and growing exodus into the more open country. Factories are being built in the country (Bournville) by the rail and canal side and often near the sea (Port Sunlight) within reach of towns and villages to which they bring new life and vigour as the result of new occupations. Thus desertion of the country and overcrowding of the towns is being counteracted. Agriculture and industry often flourish side by side.

New industries, like new colonies, start with a clear field for better methods. The old-established works and factories are controlled by other considerations. They have not only the dead weight of habit and custom, but the still greater weight of buildings, plant, transport, supplies, world-known name and address. These are often coupled with human disinclinations and prejudices, sometimes with mortgages, debts, and interests in or co-operation with other industries or firms.

Such conditions go to make up **industrial inertia,** a force which holds factories and whole industries in a locality long after the original reasons for planting them there have gone. *Reading* is still the great biscuit town. At one time its wheat supply grew near it. Most of our wheat and flour are now imported, and great biscuit factories are found in the large ports. But Reading retains its industry. Its factories, modern machinery, skilled population and world-wide reputation; its excellent road, railway, river and canal transport and its great customers in London, the Midlands, and the South; its valuable export trade through London, Southampton and Bristol enable it to hold its own in the home and the world trade. Similarly, the mushroom town of Consett,[1] having exhausted its iron-ore deposit, now employs

[1] Near Sunderland.

its great works and 10,000 workers on Swedish ore. Many towns and ports in the South and East have been less successful in resisting industrial decline. The woollen towns and ports, especially in East Anglia and Kent, have lapsed into mere villages, often with noble churches as monuments of former prosperity. Others, like Dover and Southampton, have replaced their lost wool trade by more modern forms of usefulness.

Cheap and rapid transport of raw materials, finished goods and of workers has made a great change in choosing sites. The coalfield no longer dominates the placing of modern factories. Cheap land, good transport and water, neighbouring towns to supply labour, and healthy surrounding are more important. Thus *Rugby* has now a great electrical works. Within a few miles are the coalfields, the copper and brass works of Birmingham, the skilled artisans of Coventry. It has canal, road and at least seven railway routes for transport. It is a healthy site, free from other great industries. The Maypole works (Hayes, Middlesex) are on the Great Western Railway, Grand Junction Canal and main road, labour is plentiful in the villages near. London not only imports oils and fats, but is a great consumer of the product. *Histon* has a great modern jam factory. A healthy site beside the G.E.R. line in the midst of a great fruit-growing area, with ample women workers in the villages and Cambridge, enabled this industry to develop rapidly.

Industry has brought wealth to the masters, higher wages to the men. As wealth increases human wants develop, and the larger part of the population is still engaged in satisfying them —*i.e.* in serving the community. Food, health, education, recreation are important wants. Our food is largely produced abroad, but the agricultural parts of England are now recovering their importance and even increasing their populations.

The coasts are studded with large and small towns. Their business is to restore the health of jaded town workers, to provide rest and recreation. The Yorkshire and Lancashire coast towns, *e.g.* Blackpool, owe their prosperity to the county industries.

Western Scotland is the playground of the Glasgow district. London resorts range from Southend to Torquay. South Wales supports many seaside towns on both sides of the Bristol Channel. On the West Coast Liverpool, Manchester and the Potteries use those of North Wales and the Isle of Man.

But in addition to these local playgrounds excellent railway and boat services enable every part of the British Isles to be reached by holiday-makers, who thus carry their earnings to the Highlands, Killarney or inland watering-places like Harrogate, or to the golf-courses of Fifeshire. In winter and spring people seek the warmer resorts—Bournemouth, Torquay, the Isle of Wight and the Channel Islands. Thus the wealth created in the industrial areas is distributed throughout the whole country.

The East Coast is bracing and stimulating, the towns, especially Margate, attract many delicate children, and therefore abound in boarding-schools. Educational facilities become every day more important, and great industrial towns now have their higher schools and colleges, often their universities. The older universities and schools, however, are not usually found in such towns; the conditions are not the most suitable for study. Glasgow is an example of an old university town which has become a great manufacturing centre. Watering-places and educational towns thus exploit their special resources for the good of the community and provide useful occupations just as do the agricultural and industrial districts.

TABLE IV

SOME OLDER TOWNS NOW IMPORTANT FOR HEALTH AND EDUCATION

Population in thousands

Inland Watering Places.	Pop.	Universities.	Pop.	Public Schools.	Pop.
Matlock	7	Oxford	57	Eton	4
Buxton	17	Cambridge	59	Harrow	15
Bath	69	Edinburgh	335	Winchester	24
Malvern	10	St. Andrews	8	Rugby	25
Tunbridge Wells	36	Aberdeen	165	Marlborough	5
Llandrindod Wells	2	Dublin	310	Tonbridge	15

Girls' Schools: Cheltenham, 50; St. Andrews, 8.

The twentieth century continues to bring new industries and new enterprises, but also new reasons for choosing their sites. It is not only more humane and just to provide suitable life conditions for workers, but it has been proved to be more profitable. The first Garden City (Letchworth), thirty-five miles north of London, was started in 1903. Now almost every large town has its garden village or suburb, and there are a dozen within thirty-five miles of London. Some, like Trentham, near Stoke-on-Trent, are purely residential, others, *e.g.* Letchworth, have their industries, and many, like Bournville, have grown up with and around a great industry. The great Government war factories were often built away from the large industrial towns and supplied with modern dwellings. Most large firms employ welfare workers and make special provision for supplying meals, recreation, education and medical advice for their workers.

Control of building plans by means of local bye-laws has long been in force, but varies greatly in different areas. The recent Town Planning Act gives encouragement and scope for liberal plans in laying out and building on new sites. The great shortage in houses after the war gave a great impetus to the movement. The proposed new London suburb at Dagenham (Essex) is estimated to cost £30,000,000. The Ministry of Health has now control of building schemes and town development. Unfortunately the rapid rise in cost of materials and wages in 1920 prevented the execution of many schemes.

EXERCISES

1. Name five " Garden " towns or villages and account for their prosperity.

2. Name the towns not given in Table IV. which have universities and university colleges.

3. Give six examples of Industrial Inertia (including ports). Explain the rise of and present means of supporting each industry. Name towns where the inertia and the industry have broken down, and give reasons.

4. Explain the early and later growth of Newcastle, York, Norwich, Reading, Bristol, Belfast. Which of these towns provide university education?

5. Write a short essay on Transport, dealing with its influence on the increase, distribution, occupation, and home life of the British people.

6. Explain the early and continuous growth of London in population and area, and show the difference between the City and County of London and Greater London.

7. Write a short report upon the present tendencies seen in the organisation of industrial sites and in the expansion and housing provision of your own or some near town.

CHAPTER XX

TRADE AND COMMERCE

British supremacy in trade came late and was hard won. It is based upon the natural advantages of rich mineral deposits, mild and moist climate, and accessibility by sea (for transport). Long before the Romans came Britain exported metals—lead, tin, gold, silver, and iron—and farm products, corn, cattle, hides, fleeces, slaves, and fine breeds of hunting dogs. Money was in use—iron bars, copper rings, and later, rude coins of silver and gold. Commerce lead to culture, seen in the farming, dress, home life, weapons, and utensils of the British.

Rome exploited these same resources. Great quantities of metals brought by the ancient hill track to Dover, cargoes of corn for the legions (800 ships in A.D. 359), oysters, pearls and jet, skins and wool, and slaves were exchanged for the luxuries of Roman civilisation—wines and drinking vessels, cloth of fine colours, artistic glass, tiles, marble, ivory, ornaments of gold and silver. The Britons put on culture as rapidly as did the Northmen later in France, but culture of a different type that left them no match for the fierce attacks that followed the Roman retreat.

Pushing their way steadily over the whole country and settling on the land, the Saxons showed little resource or enterprise, and little farming or industrial skill beyond the power to produce the bare necessities of life. Great numbers sank into debt and slavery. Slaves for Ireland were the chief export till the Danes came. They were men of the world; they saw and understood; they had the instincts, enterprise and grasp of traders. They had much to do with the making of the Yorkshireman and the Lowland Scot.

The great King Alfred, however, beat them in battle and in business. Building the first English fleet and borrowing sailors from overseas, he trained his men and established English traditions in good seamanship, in exploration and trade. His successors followed his example, and about A.D. 1000 the fish trade at Billingsgate was first regulated, and foreigners given permission to trade there. England was again exporting raw materials, metals, and wool and receiving the fine work of skilled artisans.

The Normans were an aristocracy and no business men, they scarcely encouraged commerce. But they prepared for it by linking England to the Continent. The export trade in metals and wool was done by the *Cinque Ports*. The rapid development of monasteries under the Normans resulted in a great uplift of craft work. The monasteries became the schools of learning and handicraft. Not only the workmen but the monks did fine work in metal, writing and illuminating manuscripts, sculpture and masonry. In this dark period of English life Ireland enjoyed her golden age. Her learning, metal work and illuminated manuscripts were famed throughout Europe and were greatly sought after. (*Cf.* map, p. 204.)

The religious houses thus became the centres of skilled workmanship. Religious enterprises (*e.g.* the Crusades) brought back to our ports—first by returning warriors then by foreign traders—trade in silk, precious stones, worked gold, spices, fine cloth, oil and weapons from Asia. Meanwhile sea and river ports in South and East England were growing, buying freedom and privileges from the King, and exporting wool, sheepskins and coarse cloth in exchange for wines and fine linen. Magna Carta provides for the safety and free movements of merchants.

In the Middle Ages *wool* was the backbone of English trade and wealth. It was exported in great quantities to Flanders and largely paid for by the cloth made from it. "All the nations of the world were kept warm by English wool." Edward I. did much to develop trade. He founded the Mint, put down

FIG. 47.—DISTRIBUTION OF MONASTERIES
(Compare this with the Wheat map, Chap. V.)

robbers and pirates, regulated the charges at ports and arranged for the collection of debts. At this time most of the foreign trade was done by the Baltic and North Sea merchants of the Hansa League, and by Italian merchants who visited the southern ports and London, bringing Italian and Oriental goods and wine. Edward III. tried many experiments in commerce. He incorporated the staple merchants and set up the staple ports, York to Exeter, which exported the staple goods, wool, leather, skins and tin. He encouraged aliens to buy and sell in England without restrictions (Free Trade). He also introduced Flemish weavers into East Anglia (1330), as Henry I. had done in Pembroke (1110). A great cloth industry developed and flourished for about four centuries.

British industries were already organised under the Gilds, societies of master men which regulated the manufacture and sale of goods. The members carried on their industry in the home or the shop and sold direct to their customers. The Flemish introduced a new industry and were not organised in gilds. They settled in the villages, and in their cottages carried on the various processes of cloth-making, working for a clothier who supplied materials and paid *wages*, and then sold the cloth. In 1350 cloth was being exported and the trade grew rapidly; the export of wool gradually ceased.

By 1500 England was exporting cloth to Flanders—formerly supreme in cloth-making. The Drapers' Company had the monopoly of the cloth trade in London and grew very rich. The Merchant Venturers monopolised the export trade and had their own fleet of ships. English merchants traded from Dantzig to Venice. The Tudors saw the importance of trade as a means to money, and made trade treaties with European countries. Other trading companies flourished under the Tudors: the Russian, the Levant (Turkey and overland to India), the Guinea, the East India, and the Eastland (Baltic) Companies were formed to export British metals and cloth and re-export the spices, silk, cottons, rich and precious stones which had been imported. The Hansa and Venetian merchants lost their trade, and before 1600 their fleets ceased to visit England.

The Free Trade policy of Edwards I. and III. had thus given way to the plan of protecting both home industries and English trade. Edward III. had encouraged foreign craftesmen to settle in England and foreign merchants to come and buy and sell goods, using their own ships. His successors gradually reversed the policy. They encouraged English merchants and shipping by restricting foreign merchants and ships. They hindered the export of raw materials in favour of sending out manufactured goods (cloth) and importing raw materials instead of goods. Thus while Edward III. received nearly £70,000 tax on wool exports, Henry VI. only collected about £12,000. This was the mercantile system under which the State increasingly controlled commerce, protecting English trade, traders and ships. The policy led later to mastery of the sea and development of colonies as markets.

At the close of the fifteenth century came the opening up of the Cape route to India and China and the discovery of America (1492). Hitherto British trade had been confined to Ireland, North-west Europe, France, Spain and the Mediterranean. English merchants with their 300-ton ships swarmed the southern English ports, of which London, Southampton, and Bristol were the chief. The south and south-eastern counties were then the land of plenty (corn, wool, cloth).

The discoveries of new lands and new trade routes came at a time of great national awakening. English merchants, adventurers and explorers, and emigrants at once entered this movement of expansion, and in the next two centuries the foundations of both British trade and the British Empire were firmly laid by British enterprise. British ships under Cabot ventured on beyond Iceland to Newfoundland and America. This led to the British exploration and colonisation of North America and opened up the great fisheries. In the Old World English merchants were pushing their trade in the Levant and along the west coast of Africa. Henry VIII. instituted a permanent Royal Navy, a Navy Board and Trinity House, and built dockyards. Merchant vessels increased from 1300 in 1582 to 7000 in 1590.

In those days the discoverers of a new route claimed a monopoly of its use. The Portuguese and the Spaniards regarded ships of other nations on their new routes as trespassers, or rather pirates, and treated them as such. Conflicts with the Spaniards in the West and the Portuguese in the East in the sixteenth century drove the English to smuggling, buccaneering, slave-trading, and exploring. Thus Drake, seeking a safe way home with his booty, sailed round the world.

In the late sixteenth century, while Raleigh and Grenville were colonising America, other adventurers were seeking a safe passage to India and new lands to trade in by the north-west and north-east Arctic seas. The search was not successful, but it resulted in trade with Russia through Archangel and Persia. Others sought trade in Asia and the East Indies *via* the Cape with considerable success, and the East India Company was incorporated on the last day of 1600. Sir Thomas Gresham founded the Royal Exchange, 1566, as a meeting-place for merchants.

Trading in the East was so successful that many companies were formed, and the rivalry with the Dutch became acute and led ultimately to war in the East and at home. Elizabeth greatly encouraged shipbuilding and trade, she cut off the privileges permitting foreign ships to engage in English trade, developed the home fishing industry (still largely in the hands of the French and Dutch) and appointed marine insurance commissioners (1601). Under the Stuarts colonisation went on rapidly.

Cromwell's Navigation Acts reserved all English import trade for English ships or those of the producing country. This greatly injured the Dutch and led to war, in which they were finally defeated. It also crippled our Baltic trade, but by the end of the seventeenth century English merchants were first in the world's trade. English fishermen were masters of their home fisheries and dominant in the whale fishing off Iceland and the cod fisheries of Newfoundland. The work of carrying and distributing the goods of other nations was rapidly passing into British hands. Cromwell had adopted the convoy system. The Newcastle coal traffic, already developing under Elizabeth, employed 1400 ships under Queen Anne, and, like the fisheries, trained great numbers of sailors.

The policy of the Tudors in protecting English industry and trade was continued into the nineteenth century. Raw materials were to be kept at home to give employment, manufactured goods, with cloth still easily first, were to be exported, and other raw materials bought in place of them. Thus it was hoped wealth and power would be acquired. Most of the wars were concerned with commerce. An attempt was made to stop direct trading between the Colonies and other countries, by compelling the Colonies to send all their exports to England, and to buy all from England. This led to wholesale smuggling and still further crippled our Baltic trade.

Home industry and commerce in this period benefited greatly by the religious troubles in Flanders and France, which drove many thousands of artisans and much money to England, and greatly improved the cloth, silk, paper and glass trades in London and the south-east counties. The trade with America in sugar and tobacco was becoming important.

While religious and political revolutions were going on in Europe, and especially in France, a rapid revolution in agriculture, industry and trade proceeded in England. In 1760 England topped the nations of the world, and was but at the beginning of her new era of production which carried her through the great wars with America and France. The loss of America freed her trade; English shipping doubled in ten years. The French wars had largely crippled Europe, and left England the chief source of woollen goods. The world was rapidly developing. The Spanish and Portuguese colonies became valuable markets for English goods. Our trade exports and imports had grown from about £4,000,000 in 1600 to nearly £60,000,000 (exports) and £54,000,000 (imports) in 1815.

TABLE IA

GROWTH OF TRADE DURING THE INDUSTRIAL CHANGE (FROM 1760)
(*In £ millions*)

Year.	Imports	Exports	Notes.
1700 .	—	6	Nearly half was woollen goods
1760 .	10	16	Water power and mills were coming into use
1782 .	10	13	The war with American colonies crippled trade
1792 .	20	25	Trade doubled in ten years with peace. Steam introduced
1800 .	30	34	English population now about nine million. Canal transport greatly facilitated trade
1815 .	54	58	Trade growing rapidly owing to Europe being crippled by Napoleonic Wars. Cotton now formed nearly half of our exports

1. The independence of the American colonies removed many trade restrictions and made them one of our best customers.

2. After 1815 Europe was exhausted and there was great trade depression for 25 or 30 years.

From 1840 to 1850 the mercantile system was abandoned and important Free Trade measures were passed. The fuller results of the Industrial Revolution were seen in the great trade advance that followed.

The wars not only injured our competitors but gave us their possessions, especially the Dutch lost the Cape, Ceylon and Malacca to us. Our colonisation of Australasia flourished so rapidly that in thirty years we received wool from there. The cotton export trade had by 1815 outstripped woollens, but our new supplies from Australia and South America restored the latter for a time. After 1850 America, France, and Germany began to compete in cotton goods, but Egypt and India added their raw cotton to the supplies from U.S.A. and Brazil. Russian flax greatly increased our linen trade, coal was sent in increasing quantities all over the world, and British iron and steel, ships and machinery, were among our best exports. In 1660 our trade was chiefly with Europe, in 1860 two-thirds of our exports were sold outside Europe and our imports became chiefly colonial and American foodstuffs (corn, meat, sugar, fruit, tea, coffee) and textile raw materials—cotton, wool and silk.

The British had gained a great lead in the world's trade, and as they felt the competition of other countries they met it by developing new resources and methods. They discovered new supplies of raw materials, cheaper and faster means of transport, better machinery and methods of manufacture, new world markets. These were exploited with great vigour and enterprise.

Trade conditions at home and abroad had now greatly changed. The elaborate system for protection for industries, trade and commerce set up by the State from the Tudors had become a hindrance and a danger. During the late eighteenth and the nineteenth century the teaching of Adam Smith was followed, and free trade was gradually applied to imports, exports and shipping. In 1849 free trade became the ruling policy. Trade made even greater strides forward—*cf.* Table II. The full use of roads, canals, railways, steamships, penny post, banks, gold coinage, marine insurance, and other facilities in which Britain was leading the world, helped greatly in her enormous trade expansion. To every foreign port a British consul is appointed to protect and advance British interests.

In the Middle Ages wool was our chief export, from the Tudors woollen goods. In the late eighteenth century cotton steadily rose to importance and in 1815 was easily first, and in spite of our great natural gifts of iron-ore and coal, textiles, with the help of the same iron and coal, have held their lead, cotton outstanding.

Table IB shows a great advance in our textile trade by 1860, and a slower but steady rise to 1890. In the last decade of the nineteenth century there was no advance, but in 1905–6–7 there was an increase of £30,000,000 in yearly textile exports. After a lull in 1908–10, the period 1911–13 shows a further increase of £30,000,000. Textiles had now become the larger half of the entire British exports, while the home consumption is also great. The total values (in pound millions) of the textile products in 1913 were roughly: Cotton, 150; woollen, 50; linen, 25; silk, 5. The *values* in 1920 rose three to four times these amounts, but the quantity of raw material consumed was generally less.

TABLE IB

GROWTH OF TEXTILE INDUSTRIES AFTER 1830

(*In £ millions*)

Year.	Weight of Raw Materials Used. *In millions of pounds weight.*				Value of Goods Exported. *In £ millions.*			
	Cotton.	Wool.	Flax.	TOTAL.	Cotton.	Woollen.	Linen.	TOTAL.
1830	243	149	194	586	18	5	2	25
1860	1,023	260	212	1,495	49	15	6	70
1890	1,618	564	220	2,402	72	24	6	102
1905	1,941	657	226	2,824	101	28	8	137
1912	2,097	757	257	3,111	122	34	10	166
1913	2,163	804	250	3,217	126.5	32.7	9.5	168.7

EXERCISE

Draw a graph to show (*a*) the actual increase of textile exports, and (*b*) the percentage increase during 1830–60, 1860–90, 1890–1905, and 1905–13.

The wonderful growth of British trade in the twentieth century with its variations is shown in Table II. Quinquennial figures are given, but intervening years of special depression or advance are given also in italics. Our trade includes a large quantity of import for re-export. The country and its chief ports serve as an *entrepôt*—a transmitting, and usually transhipping, station for goods intended for foreign or colonial consumers. The amount of this is obtained by subtracting British imports and exports from total imports and exports. The former represent the proportion of imports actually consumed by the British people and factories and the exports actually produced in the British Isles. The remainder represents part of the goods carried for the world, but most British carrying business is done by direct transport.

TABLE II

GROWTH OF TOTAL BRITISH TRADE IN TWENTIETH CENTURY

(*In £ millions*)

Year.	General Imports.	General Exports.	Total.	British Imports.	British Exports.	Total.	Excess of Imports
1900	523	354	877	460	291	791	169
1905	565	408	973	487	330	817	157
1907	*646*	*518*	*1,164*	*554*	*426*	*980*	*128*
1908	*593*	*457*	*1,050*	*513*	*377*	*890*	*136*
1910	678	534	1,212	574	430	1,004	144
1913	*769*	*635*	*1,404*	*659*	*525*	*1,184*	*134*
1914	*697*	*526*	*1,223*	*601*	*431*	*1,032*	*170*
1920	1,937	1,558	3,495	1,724	1,336	3,060	388

1. 1908 was a year of trade depression after the big increase of 1905–7. The recovery, begun in 1909, was very marked in 1910.

2. 1913 was the last year of normal trade and is quoted in most returns as a standard. 1914 shows the effects of five months' war.

3. 1920 values are due to the suddenly increased cost of production and transport throughout the world and to depreciation of the English pound.

EXERCISES

1. Construct a graph or graphs for the above Table. Draw the lines joining the amounts of imports and exports for each year. These will show the excess of imports over exports for each year.

2. Draw one graph to show what *fraction* of the British imports was in excess each year. How does this serve to correct the impression given by the previous graph?

3. What tendency is seen in the record of "Excess of Imports"? Explain the importance of this. Show how we can continue to buy more than we sell and yet accumulate wealth.

4. What was the increase per cent. in trade from 1900 to 1913? Compare it with the increase of trade in 1800 to 1900. (Tables IA and II.)

5. Calculate the value of the *entrepôt* or re-export trade of 1920.

Imports and exports may be grouped in three classes: (1) foods for man and beast, (2) materials for industry, (3) manufactured goods. The main *imports* follow this order in importance to us and are grouped under these heads in Table V., but the exports show the reverse order, and the ten most important, *except coal*, appear as wholly or partly manufactured.

TABLE III

VALUE OF TOTAL IMPORTS AND EXPORTS IN 1913 AND 1920
(*In £ millions*)

	Total Imports.		Total Exports.		British Exports.		Foreign and Colonial Exports.	
	1913.	1920.	1913.	1920.	1913.	1920.	1913.	1920.
I. Food, drink, tobacco . .	295	767	50	97	34	51	16	46
II. Raw materials	270	712	132	274	68	151	64	123
III. Manufactured goods . .	203	457	453	1,187	423	1,134	30	53
Totals in £ millions	768	1,936	635	1,558	525	1,336	110	222

In 1913 the tonnage (excluding coasting trade) of vessels entering and clearing from British ports was 107 million; of this 44 million was foreign, whereas in 1920 it was 73 million, 23 million foreign.

EXERCISES

1. Find the total trade of the British Isles in 1913 and in 1920.

2. What percentage of the total (*a*) imports, (*b*) exports, does each class of goods form? How has this percentage been affected by the war?

3. Compare the total trade of 1913 and 1920 as judged by (*a*) value, (*b*) tonnage.

TABLE IV

GROWTH IN EXPORT OF TEN IMPORTANT CLASSES OF BRITISH GOODS
(*Value in £ millions*)

Goods.	1840.	1913.	1920.	Chief Buyers (£ millions) 1913.
Clothes and Books	.6	21	49	S. Africa (3.6), E. Indies (1.2), New Zealand (1.2)
Coal	.6	51	100	France (8), Italy (6.9), Germany (5.3), Russia (4.3)

TABLE IV.—*continued*

Goods	1840.	1913.	1920.	Chief Buyers (£ millions) 1913.
Cotton Yarn	7	15	48	Germany (5.1), Holland (1.8), Switzerland (.95)
Cotton Goods	17	111.5	354	Bengal (16.8), Bombay (13.3), China (11.7), Turkey (4.2)
Vehicles, Locos, Cars, Ships	—	24.5	60	*E.g. Railway engines.* India (.84), Argentine (.7)
Iron and Steel	2.5	55.4	129	*E.g. Pig-iron.* U.S.A. (1), France (.6), Germany (.4) *E.g. Tinned and Galvanised.* India (3.8), Australia (2)
Flax and Hemp Yarn	.6	1.22	1.73	Germany (.4), Belgium (.22), U.S.A. (.12), Spain (.1)
Linen Goods	3.27	8.25	22	U.S.A. (3), Australia (.5), Canada (.3), Cuba (.2)
Machinery	.6	33.6	64	*Textile Machinery.* E. Indies (2), Russia (1), Germany (.8) *Machinery.* Europe (2.5), America (1.25), India (1.1)
Non-ferrous Metals	2	12	26	*Copper bars, goods, etc.* France (.5), Holland, Italy *Lead.* Russia, Canada, France *Tin.* U.S.A., Russia, Canada, France, Sweden
Beer and Spirits	.36	4.2	10	Australia (1), Canada (.7), E. Indies (.8), S. Africa (.2)
Woollen Tops and Yarn	.45	11.7	16.6	Germany (4), Japan (.7), Sweden (.5), Denmark (.2)
Woollen Goods	5.3	24	112.5	Canada (2.7), Germany (2), Australia (1.7), France (1.7)

If the *quantities* of goods exported were quoted they would show a great decline of exports in 1920—*e.g. Coal* export, 1913, was 73 million tons (besides 21 million tons shipped for use of steamers abroad and not counted as export). In 1920 it was 25 million tons and 14 million for steamers. Similarly machinery 700,000 tons against 462,000 tons (1920), and cotton yarn 17 million lbs. against 7.7 million lbs.

EXERCISES

1. Make separate lists of countries buying prepared materials (yarn, pig-iron, etc.) and those buying the finished goods. Explain the differences in the grouping.

2. As far as shown in Table IV. compare the relative importance to us as customers of (1) Europe, (2) North and South America, (3) The Empire, by making three separate lists and totals of their imports of British goods.

3. Which of the above exports depend on imports, and how do they benefit us?

4. How far is it true that the price of exports is made up of the cost of material, power, brains, capital? State the nature of any other charges which there may be.

TABLE V

Chief Imports

(*In £ millions*)

Class of Imports.	1913.	1920.	1913 Imports (£ millions), giving the chief sources.
I. Food, Drink, Tobacco	**295**	**767**	=Total Value
E.g. Grain and flour	84	232	*E.g. Wheat.* U.S.A. (14), Canada (9), Br. E. Indies (8), Argentine (6)
Meat (dead)	56	142	*E.g. Beef and Mutton.* Argentine (3 and 2), Australia (2 and 3), Uruguay
Food and Drink, Undutiable	82	175	*E.g. Butter.* Denmark (10.6), Russia (3.8), Sweden (2), France (1.5)
Food and Drink, Dutiable	59	175	*E.g. Sugar* (refined). Germany (6), Austria-Hungary (2.6), Holland (2.5) *Tea.* India (8), Ceylon (4), Dutch E. Indies (1), China (.6) *Wine.* France (2), Portugal (.9), Spain (.45), Germany (.3)
Tobacco	8	36	U.S.A. (5.7), Cuba, cigars (1), Egypt, cigarettes (.08)
II. Raw Materials	**270**	**712**	
E.g. Raw Cotton	71	257	U.S.A. (47), Egypt (18), Brazil (2), Br. E. Indies (1.2)
Wool and Rags	38	94	Australia (12), New Zealand (8), S. Africa (5), Argentine (2)
Timber	34	72	Russia (11), Sweden (4.5), Canada (4.5), U.S.A. (4), Norway (1.5)
Nuts, Oils, Resins	30	82	*E.g.* Linseed (7.2), Cotton-seed (4.6), Resin (1.1), Tallow (3.2)
Rubber	22	27	Brazil (6), Straits Settlements (5.3), Malay[1] (3.5), Ceylon (2.3), Peru (.5)
Raw Hides and Skins	15	32	S. Africa (2), Australia (1.5), New Zealand (.6), Argentine (1), Italy (.5)
III. Articles Manufactured	**201**	455	*N.B.*—The goods are partly or wholly manufactured
E.g. Non-ferrous Metals	30	39	*E.g. Copper.* U.S.A. (3.8), Australia (1.5), Chile (.5), other countries (1.5) *Lead.* Spain (1.4), Australia (1.3), U.S.A. (.4), Mexico (.2)

[1] Federated Malay States.

TABLE V. CHIEF IMPORTS—*continued*

Class of Imports.	1913.	1920.	1913 Imports (£ millions), giving the chief sources.
III. Articles manufd. *contd.*			
Iron and Steel Gds.	16	29	Germany, Sweden Belgium, U.S.A.
Silk and Goods	15	37	*Goods.* France (5.6), Switzerland (3.3), Germany (2.2), Japan (1.1)
Oils, Fats, Resins	14	77	*E.g.* Petroleum (11), Paraffin Wax (1), Turpentine (.8), Soap (.5)
Chemicals, dyes	13	35	*E.g.* Sodium nitrate (1.5), Coal Tar Dyes (2), Painters' Colours (1.8)
Leather Goods	12	21	Leather, Dressed. U.S.A. (2), Germany (1.7), France (.7)
Apparel and Boots	11	15	Outer Garments (3.8), Boots (.9), Gloves (1.8), Underwear (3.5)
Woollen Yarn and Goods	10	18	*Goods.* France (3.5), Germany (1.5), Yarns (3.5), Carpets (.7)
Cotton Yarn and Goods	9	10	Piece Goods (3.3), Lace (2.3), Ribbon, etc. (1), Yarns (.56)
Paper & Cardboard	8	30	Sweden (1.2), Norway (1.2), Germany (1.4), Newfoundland (.4)
Machinery	7	20	Electrical (1.35), Agricultural (.8), Typewriters (.5), Textile (.4)
Total of Classes I., II. and III.	766	1,934	Add £2.5 million worth imported by Parcel Post each year

1. The war cut off some supplies and greatly increased those of the Dominions, U.S.A., and South America.

2. The great increase of 1920 is not due to increased imports or entirely to the change in money value, but often to the relative inflated costs of the goods.

EXERCISES

1. Name the main groups of imports. Knowing these and the population of the British Isles, what can you deduce as to the probable occupations, exports, and wealth of our country?

2. Draw up a list of (*a*) the Dominions, (*b*) the chief European, and (*c*) the American countries, named in Tables IV. and V. Fill in the imports from and exports to each. From these tables deduce the chief occupations and developed resources of each country.

3. Collect and compare the amounts of our (*a*) sales to, (*b*) purchases from the U.S.A. If they differ greatly in value how can we continue to purchase?

A very important article of commerce is gold and silver *bullion and coin*. In 1920 we *imported* gold £50.7 million, *e.g.*, from Transvaal (36), France (6.7), Rhodesia (2.3), Russia (2), West Africa (1); and silver £10 million, *e.g.*, from France (3.9), U.S.A. (1.3), Holland (.8), Belgium (.7), Canada (.7). We *exported* gold £92.6 million, *e.g.*, to U.S.A. (53), India (23.6), South America (5.7), Straits Settlements (3.7), South Africa (3.6), Switzerland (.7); and silver £11.5 million, *e.g.*, China (5), India (3.8), West Africa (1), South Africa (.3). The total trade in gold and silver bullion and coin was £165 million. This does not appear in the returns of exports and imports.

The British Isles have a great many excellent ports, of which twenty had a pre-war entering and clearing tonnage of over 2,000,000. The most important are shown in the diagrams of tonnage (Imports and Exports) (Fig. 48). In 1912 the coastal trade amounted to 60,000,000 tons, which is not included in the tonnage shown.

The trade of each port depends upon the products and needs of its hinterland, and the value of its trade is often not in proportion to its tonnage. Thus large vessels enter Plymouth and Southampton, but chiefly to embark or land passengers. The South Wales and Tyne ports handle chiefly coal, and their values are much lower in proportion than those of ports sending out textiles and machinery. Hence it is that Hull comes into third place. Similarly, imports and exports differ in character and value and the order of ports varies accordingly.

London's great railway system brings to her manufactured goods (£60 million) from the metal working, cotton and woollen areas, and distributes to them the foodstuffs (£100 million). The export of manufactured goods (£60 million) balances the import of materials, but she has little foodstuff or materials to export. The other ports, serving each a great industrial hinterland, import foodstuffs, especially wheat. (We imported over £88 millions worth of grain and flour in 1912 and in 1913.) Liverpool puts raw materials before food, and with Hull imports

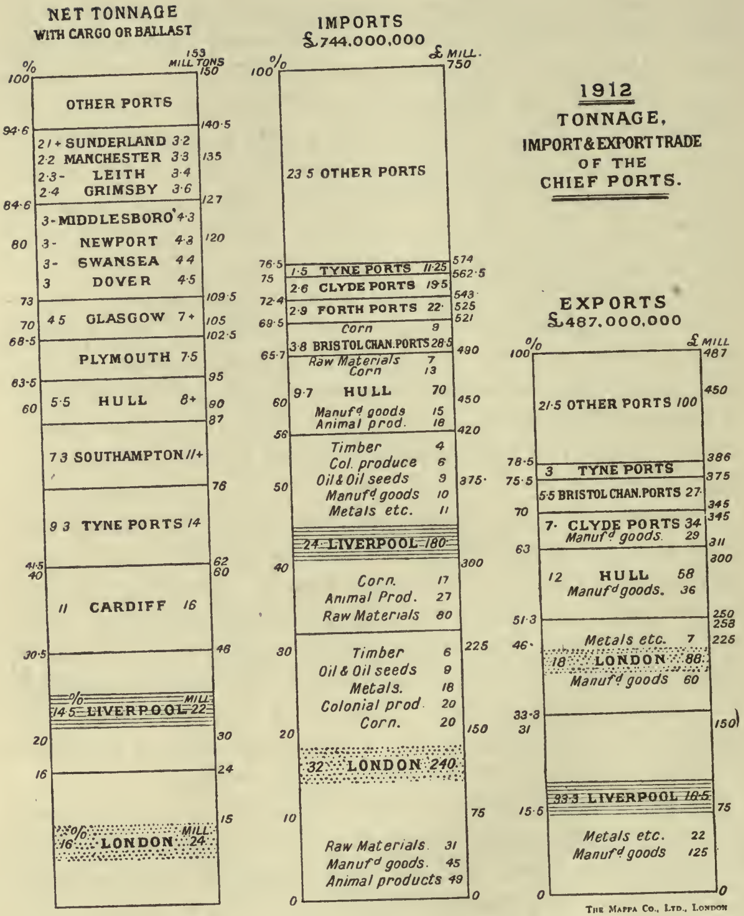


FIG. 48.—DIAGRAM SHOWING GRAPHICALLY THE TRADE (TONNAGE, IMPORT AND EXPORT VALUES) OF THE BRITISH PORTS

considerable supplies of manufactured goods. Hull specialises in wool, and all ports make metals and minerals, especially iron-ore, iron and steel, an important item. Copper and tin go to London, Liverpool and Swansea.

England and Wales took 91 per cent. of the imports; Scotland, 7 per cent.; Ireland 2 per cent. The exports were supplied in the proportion 91 per cent., 8.8 per cent. and .2 per cent. About one-third of the import and export trade is colonial and two-thirds with foreign countries.

London had half the *entrepôt* trade of £212 million, Liverpool just over a quarter and Hull 5 per cent., leaving only about 17 per cent. for all the other ports. London's great and varied Continental, Atlantic, Asiatic, and Pacific commerce enables her readily to attract and despatch such trade.

EXERCISES ON THE DIAGRAM

1. Of the remaining British ports whose trade is under £2,000,000 five are English, with £8,000,000 trade, and three are Scottish, with £5,500,000. Draw a diagram to represent the percentage and tonnage of trade in English, Welsh and Scottish ports. (*Cf.* Table V. p. 160.)

2. Draw a diagram to your own scale to show the total trade of each port.

GENERAL EXERCISES

1. Write a short essay on the growth of British trade in the nineteenth century.

2. What is meant by the "exchange being against us" in America? How is the exchange related to our export and import trade?

3. State as precisely as you can the chief ways in which the late war has affected British import and export trade, and show how far the changes seem likely to be permanent.

II—ENGLAND AND WALES

CHAPTER XXI

THE SOUTH-EASTERN SCARPLANDS: THEIR RIDGES, VALLEYS AND BASINS

TRACE on an orographical map the line of oolite hills from the Cotswolds through the Edge Hills, the Northampton Heights, and Lincoln Edge to the North Yorkshire Moors.

Identify the *great oolite band* on the geological map, and notice that it extends from the Dorset coast in a continuous belt to the Humber, where it disappears to reappear again in north-eastern Yorkshire. This oolite belt we will take as the western boundary of the area to be studied in this chapter.

Physical features.—The outstanding features of south-east England are the long ridges and valleys, the basins and plains which form the undulating country and plainland of the Home Counties and neighbouring lands.

The diagram shows clearly the main structural features:

(1) The *oolite ridge* with west-facing escarpment.

(2) The *chalk ridges* radiating from the undulating Salisbury Plain and the Hampshire Downs:

- (*a*) White Horse Hills, Chilterns and East Anglian Heights, coming to the sea in the cliffs of Hunstanton Point.
- (*b*) The North Downs with many river gaps, whose seaward cliff-edge is at Dover and the South Foreland.

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FIG. 49.—THE SOUTH-EASTERN SCARPLANDS

(*c*) The South Downs with many river gaps, terminating in the great headland of Beachy Head.

(*d*) The Western and Purbeck Downs, ending in the chalk cliffs near Swanage.

(3) The long *clay trough* between the oolite and the chalk, including the Vale of Oxford (Upper Thames Basin) and sloping to the flat Fens around the Wash.

(4) The *three great basins* of the chalk-lands:

(*a*) The London Basin or Lower Thames Basin.

(*b*) The Basin of the Weald.

(*c*) The Hampshire Basin (including the Isle of Wight).

Notice how the escarpments of the chalk are arranged. The accompanying sections explain why the " scarps " face as they do.

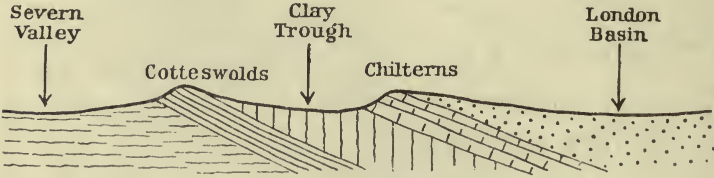

FIG. 50.—SECTION ACROSS OOLITE AND CHALK ESCARPMENTS

Rivers.—The chief river of south-eastern England is the *Thames*, which rises in several springs in the oolite Cotswolds, and flows across the upper basin, through the great gap which it has cut in the chalk (Reading or Goring Gap), and meanders in swinging curves over the level lands of its lower basin to the Thames estuary with its submarine delta.

Trace the chief Thames tributaries. Notice that while most of the southern streams cut their way through gaps in the North Downs, the northern streams flow down the oolite and chalk slopes. In past ages streams made gaps in the Chilterns; but subsequent changes in level and slope have made these gaps waterless. They have been weathered and widened by denudation, and are known as " wind-gaps." These Chiltern wind-gaps are of great importance, for through them pass the great main railways from London to the north and north-west. (See Fig. 51.) The Thames is linked with the Severn by (1) the *Thames-Severn Canal*, now derelict; and by (2) the *Kennet and Avon Canal*, by way of the tributary Kennet and the Bristol Avon.

From the chalk ridges north of London sluggish streams wind down through the pastures and arable lands of East Anglia to their mud-flats and estuaries on the coast, which invited piratical Saxon and Dane to the raiding, conquest and colonisation of south-east England. The Norfolk *Yare* and its tributaries once had a great estuary that reached to near where Norwich now stands. But the estuary has been silted up, and its mouth almost barred off from the sea by river deposits; though parts of the old estuary still remain in *The Broads* beloved of the angler and holiday-maker. The rivers of the *Wash* have also silted up their estuaries, and the Wash is gradually growing shallower. The Fenlands consist of fine silt brought down by the Witham, Welland, Nen and Great Ouse. The sea is kept out, as in Holland, by dykes in many places; and the land is kept drained by an elaborate network of ditches, dykes, and canals with steam-pumps and windmills. The sea-tide pushes far up these rivers, brimming them from bank to bank. At ebb the sluggish brown water is narrowed between wide sloping banks of mud and slime.

Wealden rivers flow, some to the north of the Thames, some to the south and the Channel. All are unimportant save the *Medway*, whose estuary forms the harbour of Chatham and Sheerness. Their gaps, however, in the chalk are important, because they provide natural gateways for the passage of the great main roads and railways to the south.

Southampton Water is the great drowned lower valley of the *Test* and *Itchen*.

Climate and Vegetation.—South-eastern England is the driest part of Britain, and the most extreme (especially in the east).

(1) It lies on the eastern—leeward—side of our islands.

(2) It is near enough to the Continent to be influenced by continental weather.

It is a region of woodland, grassland and ploughland.

(1) Remnants of ancient *forest* occur on the Cotswolds and Chilterns, in Epping Forest and Enfield Chase, and in the Wealden and Savernake Forests. The Chiltern beeches have given rise to the *chair-making* industry centred at High Wycombe.

(2) The long valley-trough of clays and sand between the oolite and the chalk has splendid *pastures* for *cattle* (dairy industry around Aylesbury, for instance), while the hill-slopes provide food for large numbers of *sheep*. The flat Fenland, drained and scientifically manured, has become famous for its *fruit*, *potatoes*, and *celery*.

(3) The boulder-clay-covered lands of East Anglia and Lincolnshire are Britain's finest *wheatlands*, because their climate is driest and sunniest and soil is suitable.

(4) The siltlands of the lower Thames valley are utilised as *market-gardens* for supplying London with vegetables, flowers and fruit. They contain also rich brick-earth, and provide building material for town development.

(5) The rich soil of warm, sunny Kent, Surrey, Sussex and Hampshire has resulted in the famous *orchard* and *hop-gardens* of these counties. The Downlands support large numbers of *sheep* and some cattle and horses.

Manufactures.—All these facts suggest that south-east England is mainly an agricultural-pastoral region. There is no coal, save in Kent, where mines are in course of development, and there are no great metal deposits, so that there are no great manufacturing and mining areas as in the Midlands and the North. Iron occurs in the Weald, which before the Industrial Revolution was the chief centre of iron-smelting, because the Wealden forests supplied the charcoal and the Wealden sands the iron. But with the development of the coalfields the iron industry passed to the Midlands and North and to South Wales.

London, however, has almost every type of manufacture —not because of local resources, but because all roads and all seaways lead to London, and because she has in her own vast population a ready market.

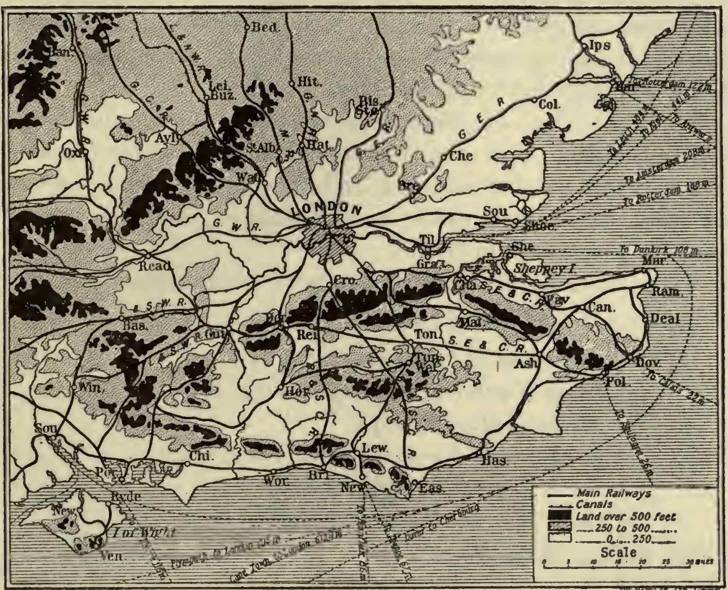

FIG. 51.—LONDON THE FOCUS OF ROUTES

Towns like Lincoln, Norwich, Ipswich, and Bedford—the market centres for rich farming areas—manufacture *agricultural implements*. The hides of local cattle and the accessibility of tanning-bark led to the establishment of the *boot and shoe* industries of Norwich and Ipswich, and of the Northampton-Kettering district. To-day the industry has grown enormously and is fed mainly by imported hides and leather.

The long-stalked wheat of the Dunstable, Luton and Bedford areas gave rise to the *straw-plait* and straw-hat industry—which is now fed by imported straw from China and other distant sources of supply. Other industries will be noted in the detailed study of the several regions.

Communications.—London is the great natural focus of routes, because it is the great gateway of trade. Through London Britain looks out upon the world: to London come ships from all parts of the globe; from London are distributed many of our manufacturing products, but particularly goods from overseas destined for Western Europe.

The map, Fig. 51, shows the importance of London as a railway centre, and the railways which converge upon it. More or less parallel with the railways are the roads—several of them old Roman roads so well-planned that they survive to-day as highways of traffic.

Trace carefully the following railway communications:

(1) The *Great Eastern* system serving East Anglia.

(2) Routes across the Chilterns:
- (*a*) *Great Northern* (Stevenage Gap).
- (*b*) *Midland* (Luton Gap).
- (*c*) *London and North Western* (Tring Gap).
- (*d*) *Great Central* (Wendover Gap).
- (*e*) *Great Western* (High Wycombe Gap).

(3) Routes to the West.
- (*a*) *Great Western* (Reading Gap).
- (*b*) *London and South Western* (Basingstoke Gap).

(4) Routes to the South and South-east.
- (*a*) *London and South Western* (Guildford Gap).
- (*b*) *London, Brighton and South Coast Railway* (Dorking Gap and Reigate Gap).
- (*c*) *South Eastern and Chatham Railway* (Dorking Gap and Sevenoaks Gap).
- (*d*) *London, Tilbury and Southend.*

Defences.—The defences of south-east England are of necessity

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FIG. 52.—DEFENCES OF SOUTH-EAST ENGLAND

of great importance, since they are designed mainly to protect the heart of the Empire.

The great military camps and garrisons of *Colchester*, *Aldershot*, *Guildford*, *Norwich*, *Canterbury* and *Winchester* provide the nucleus of a strong defending army. Colchester is at the back of *Harwich*, an important naval base. Aldershot and Winchester are at the back of *Portsmouth*, our great naval station, and *Southampton*, our great transport centre. *Shoeburyness* and *Sheerness* are part of the strong Thames estuary defences. *Chatham* has big naval barracks. *Dover*, with the military station of Canterbury behind it, is a fortified naval harbour. No part of the British Isles is so elaborately defended against invasion as south-eastern England, for it is there that Britain is nearest to the Continent, and most open to attack.

Ferry-towns to the Continent.—This area, from its nearness to the Continent, has important ferry-towns, whence steamers run regularly to continental harbours, connecting British railway systems with continental ones. These communications are shown in Fig. 39, and may be summarised thus:

Ferry-towns.	Railway.	Passage in Miles.
Harwich—Hook of Holland	G.E.R.	106
Harwich—Esbjerg	G.E.R.	337
Harwich—Antwerp	G.E.R.	135
Queenborough—Flushing	S.E.C.R.	109
Dover—Ostend	S.E.C.R.	68
Dover—Calais	S.E.C.R.	21
Folkestone—Boulogne	S.E.C.R.	26
Newhaven—Dieppe	L.B.S.C.R.	67
Southampton—Havre	L.S.W.R.	112
Southampton—St. Malo	L.S.W.R.	151
Weymouth—Channel Islands	L.S.W.R.	75

QUESTIONS AND EXERCISES

1. Why are the English Scarplands so called? Draw a sketch to show what the term includes.

2. Distinguish between " water-gaps " and " wind-gaps " with reference to particular examples

3. Explain the origin of Beachy Head, The Broads, Southampton Water, Dungeness, and the Fens.

4. Construct a simple diagram to show the importance of London as a focus of routes.

5. Draw a section to show relief and structure along a line joining London and Brighton *or* Aylesbury and Tonbridge.

6. Make skeleton maps to show (*a*) the Great Eastern Railway main lines, (*b*) London, Brighton and South Coast Railway, (*c*) South Eastern and Chatham Railway.

CHAPTER XXII

THE THAMES BASIN

The Thames rises in the oolitic Cotswolds, and in its eastward course to the North Sea it cuts across (1) the clays of the Oxford Vale; (2) the chalk of the great chalk belt that runs north-eastwards from Salisbury Plain to the Wash, and (3) the clays and gravels of the London Basin.

Its basin falls into two main divisions: (1) The Upper Basin between the oolite and the chalk, with Oxford as centre; and (2) the Lower or London Basin between the chalk and the sea, —which includes most of East Anglia. The tributaries of the Upper Basin come chiefly from the oolite, *e.g.* the Windrush and the Cherwell. The Thame, however, is a longitudinal stream draining the clay trough and flowing more or less parallel with the western steep edge of the Chilterns.

The tributaries of the Lower Basin come from the northern chalk (*e.g.* Colne, Brent, Lea, Roding) or from the Wealden Basin through gaps in the southern chalk (*e.g.* Blackwater, Wey, Mole, Darent, and Medway). The Kennet, which joins the main river at Reading, flows from the White Horse Hills, and provides a natural route for road, canal and railway to Bath and Bristol.

Physically, then, the Thames Basin includes part of the Weald, into which many of the southern tributaries have cut their way back through the chalk, creating gaps in which important gap-towns like Guildford and Dorking have sprung up. We shall find it an advantage, however, to treat Wealden lands in a chapter to themselves; and to deal here with the London Basin as the area between the northern and the southern chalk.

The Thames passes from its upper to its lower basin by the Reading and Goring Gap, between the White Horse Hills (Marlborough Downs) and the Chilterns. This gap is of great importance, providing as it does a natural route for road and railway westward and northward from London.

The Upper Basin.—The Cotswold region, where the Thames has its head-waters, consists chiefly of bare uplands with deep wooded valleys of beech and fir. The uplands support sheep, famous for their fine wool; and the presence of clear running water for cleansing and for cheap power led to the establishment of flourishing cloth industries, which have long since decayed. *Chipping Camden*, *Chipping Norton*, *Stow-on-the-Wold*, and *Northleach* were the great collecting centres for wool during the Middle Ages. *Witney*, in Oxfordshire, still manufactures woollens, especially blankets. The glove industry, carried on from very early times, still survives in *Charlbury* and *Chipping Norton*. The fine building stone of the Cotswolds is largely used in the towns and villages of the slopes and valleys. In the clay vale of Oxford, agriculture and dairy-farming are the principal occupations, and *Aylesbury* and *Oxford* are great market centres for dairy produce, corn and vegetables. Large quantities of butter, cheese, poultry and eggs are sent to London. The local brick-earths make brick-making a common industry. Most of the important market centres in the Oxford plain have grown up at fords, *e.g. Oxford*, *Wallingford*, *Thame*, and *Abingdon* (once a cloth-weaving town); or stand in or before the gaps in the uplands, *e.g. Swindon* (the great engineering centre of the G.W.R. and an important railway junction), *Wantage* (birthplace of Alfred the Great), *Tring* (the " summit " of the Grand Junction Canal), *Wendover*, *Prince's Risborough*, and *Watlington*.

In the Kennet basin dairying is carried on, and sheep are reared on the uplands. A string of market towns—*Hungerford*, *Newbury* (races), *Pewsey* and *Devizes*—marks the line of the Kennet valley. *Devizes* is famous for Wiltshire bacon.

Reading, a university and manufacturing town and a railway junction at the confluence of Kennet and Thames. Its flourishing cloth industry, which had made it a leading cloth-weaving town since the fourteenth century, was totally destroyed during the wars of the Great Rebellion in the seventeenth century. To-day it has important biscuit factories (originally based on local wheat and flower-milling), market gardens and seed nurseries, and engineering works and breweries.

The Lower Basin.—The London Basin consists of a deep deposit of sands, gravels and clays lying in a great downfold of the chalk.

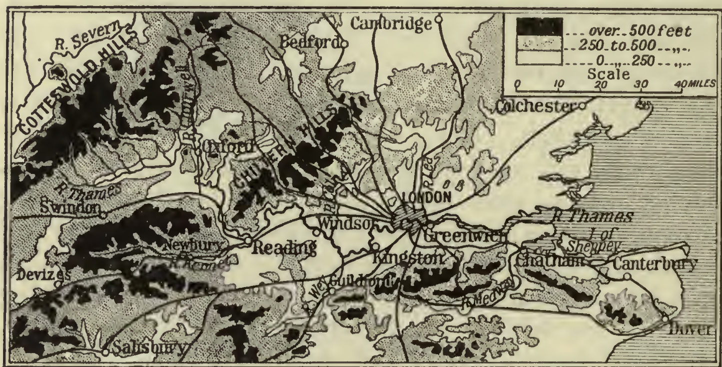

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FIG. 53.—THE THAMES BASIN: RELIEF AND ROUTES

Rain falling on the chalk outcrops to north and south flows along the chalk stratum, held up by the impervious clays beneath it, and accumulates in the bottom of the downfold. This makes possible the artesian bores which supply London with some of its water for drinking and for various industries.

Where caps of Bagshot Sands cover the London Clay heaths and pinewoods occur, *e.g.* around *Bagshot*, *Aldershot* (the great military camp), and Windsor Forest. The tops of Hampstead Heath and of High Beech (Epping Forest) are caps of sand of the same age.

Outside the London area, the chief industries are agriculture and market gardening. The fine wheat and pure water of the Chiltern slopes gave rise to (*a*) straw-plaiting at *Dunstable*, *Luton*, *Hertford*, *St. Albans* and other centres; and to (*b*) paper-making (*e.g.* Croxley Mills, near Watford), which is also carried on in the lower Thames region at *Dartford* and *Greenhithe*.

In the fine silt of the valley and on the gravels of the estuary shores market gardening and fruit-growing are important industries. There is a ready market close at hand in London and its suburbs.

The beech forests of the Chilterns have given rise to furniture-making at centres like High Wycombe. The map on p. 225 shows the main railways radiating from London. All except those running east have to pass through gaps in the chalk rim of the London Basin. (See p. 226.)

The Thames and London.—The Thames is a tidal river as far as *Teddington* ("tide-ending-ton?")—a fact which has played an important part in the rise of the Port of London and the development of the river as the main gateway into Britain.

Twice a day the flood-tide pushes up-stream for seventy miles, bearing on its bosom fleets of heavily laden barges and lighters whose only motive power is that of the river. Twice a day the ebb-tide allows easy, cheap transport down-stream. At London Bridge the tidal range is thirteen feet at neap-tide and twenty feet at spring-tide; and this tidal range has necessitated the construction of the great docks wherein ships can be loaded or unloaded undisturbed by the tidal rise and fall.

London, "the Imperial Port" and the chief city of the world, was not always the capital of Britain and the centre of world trade. Winchester long ago was England's capital; and London as a port was far outstripped by Bristol and Southampton.

London first grew up on a patch of dry ground above the swamps bordering the river, at a point where a bridge could be built and near a ford (Westminster), which was the earliest crossing place of the river. ("Lyn-dun," "the fort by the pool," had the little Wallbrook as its first "port.") The Romans brought their great road here from the south-east coast, and afterwards built the first "London Bridge," at the limit of sea-navigation.

London is what it is to-day because:

(1) Its estuary looks towards the richest and busiest countries of the European continent.
(2) The tidal flow of the Thames admits large vessels and provides cheap transport.
(3) It was the most convenient port of entry for goods from Europe in the days when England was in the making.
(4) The Romans based their great system of roads upon it and laid the foundations of London's commerce.
(5) All great railways of Britain converge upon it. London is the main focus of transport in the British Isles.
(6) The construction of large docks and warehouses to keep pace with growing trade has kept the port abreast of the times and open to the largest cargo steamers.

The London Docks, formerly under various controls, were brought under the Port of London Authority by the Port of London Act (1908). The Port of London Authority controls the Thames, its docks and many of its warehouses from the sea to Teddington Lock.

St. Katherine's Docks, near the Tower, face the "Port of London." Tea, indigo, scent, spices, tortoiseshell, mother-of-pearl, wool, hops, and ostrich plumes may be seen in the warehouses.

London Docks, close by, house elephant tusks, spices, cinchona, wool, gums, oils, quicksilver, rubber, wine and spirits.

Surrey Commercial Docks are famous for timber and grain, and for general Canadian produce—cheese, bacon, wheat, barley, oats and maize. Enormous elevators store the grain in the granaries and mills.

West India Docks, across the neck of the peninsula known as the "Isle of Dogs," store sugar, cabinet woods, frozen meat, grain, rum and molasses.

Millwall Dock on the Isle of Dogs specialises in grain and has the most up-to-date machinery for handling this type of cargo. Here is the Central Granary, which is fed by elevators that can suck up 300 tons of grain per hour—500 tons per hour if the floating pneumatic elevators are used as well.

East India Docks store much the same produce as the West India Docks.

Victoria and Albert Docks are the largest of all, stretching over three miles along the river, with warehouses covering an area of over 4,000,000 square feet. They shelter about one half of London's yearly tonnage. Tobacco, grain, frozen meat, wool and other cargoes find storage here.

Tilbury Docks, opposite Gravesend, harbour some of our biggest ocean liners, especially those trading to the East and to Australasia.

London is also a great manufacturing city: almost every industry in Britain finds a home there, in spite of the fact that London has no local resources—no coal and no raw materials. But London is easily accessible by land and sea, and all coal and raw materials can easily be brought there. Its factories are extending in all directions along its wonderful system of radiating railways. A common type of factory is that in which goods are made from partly manufactured materials.

Farther down the river are *Woolwich*, the seat of great Government ordnance factories; *Greenwich*, famous for its observatory and naval hospital; *Tilbury* and *Gravesend*, the outports of London; *Southend*, the Londoner's seaside playground; *Shoeburyness* and *Sheerness*, the fortresses which form part of the Thames defences; and *Queenborough* and *Port Victoria* at the Medway entrance, whence ferry-steamers go to Holland and Belgium.

QUESTIONS AND EXERCISES

1. Explain the conditions which make artesian wells possible. Illustrate by reference to London conditions.

2. Draw a map of the Port of London, naming the bridges and the chief docks.

3. Account for the great growth of London suburbs during the last fifty years.

4. Discuss the importance of Aldershot, Maidstone, Colchester and Winchester as military centres.

5. What are the chief disadvantages of the Thames Estuary as a highway of navigation, and how have they been overcome?

6. Contrast the appearance and importance of the Thames below London Bridge with those of the river above Teddington Lock.

CHAPTER XXIII

THE WEALDEN LANDS

The Weald proper is the region between the North and South Downs. It derives its name from the ancient forest of Andred's Weald, which in Saxon times covered almost the whole area, and formed a serious obstacle to the advance of the Saxon invaders. Even now, when large areas of the old forest have been destroyed, the Wealden counties have the biggest proportion of forest land in Britain. On the map the Weald appears as a wide basin with the Forest Ridges dividing it longitudinally into two long valleys. A rough geological section across it from north to south gives the following information:

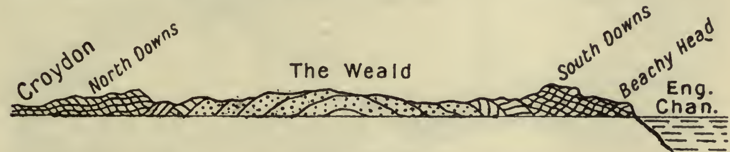

FIG. 54.—SECTION ACROSS THE WEALD

It seems probable that the scarps of the North Downs and South Downs are the worn-down remnants of a great chalk down that once arched from Thames to Channel, with its top some 3000 or 4000 feet above sea-level, as shown in Fig. 55.

From the crest of this long dome streams flowed north to the Thames valley and south to the Channel, cutting into the chalk and wearing back their sources. At the same time the arch of chalk was being gradually weathered down until the chalk was worn away and the next layer exposed only to be worn away in its turn. Geologists say that this wearing-down process went on until a great horseshoe-shaped hollow was carved out, exposing the edges of a number of different strata as shown in the geological map.

FIG. 55.—THE CONJECTURAL WEALDEN "DOME"

It is as if a gigantic gouge had been thrust slantwise into the Wealden dome at the Hampshire Downs and pushed steadily south-eastwards. The Forest Ridges are made of hard sand-

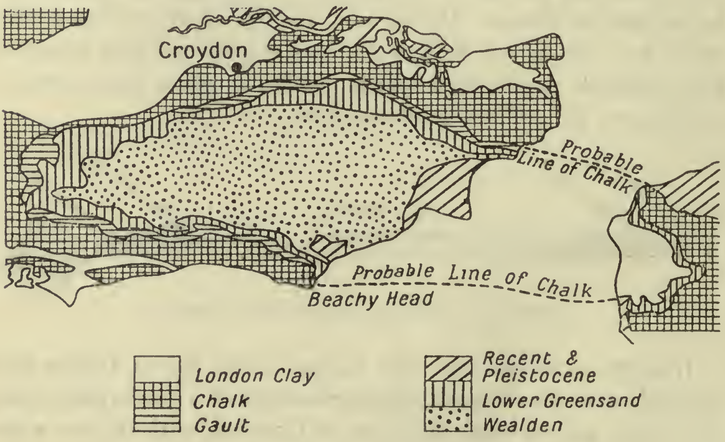

FIG. 56.—GEOLOGY OF THE WEALD

stone, which has resisted weathering more than the softer clays and sands.

Drainage.—The drainage of the Weald presents some interesting peculiarities. Almost every Wealden river has a pronounced elbow-like bend in it. This feature is generally explained as follows:

At first drainage was either (1) north to the Thames, or (2) south to the Channel, cutting deep valleys in the chalk. When the ancient chalk dome was weathered down, and valley troughs developed north and south of the sandstone Forest Ridges, a new drainage system was set up, running south-eastwards or eastwards along the valley troughs.

The old rivers gradually cut back until they tapped parts of

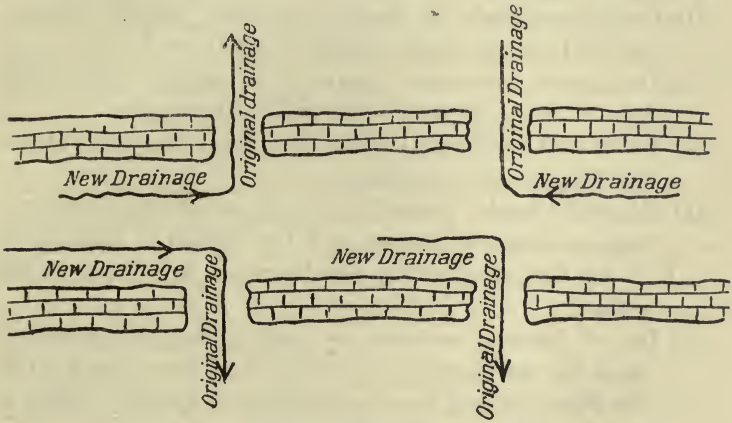

FIG. 57.—DIAGRAM TO EXPLAIN WEALDEN DRAINAGE

the new drainage systems and diverted them to themselves, thus producing the elbow-bends characteristic of Wealden rivers. This process is termed "river-capture." The Lincolnshire Witham is another example; it is said that its upper course was formerly a Trent tributary which was beheaded by the cutting back of the old Witham through the oolite of Lincoln Edge.

The gaps cut by Wealden rivers in the chalk ridges are of great importance, for through them pass the main lines of transport. Where traffic routes converge upon a natural gap, a town springs up; thus the most important Wealden towns are "gap-towns." Find the following on the map:

Gaps.		Gap-towns.
North Downs	Wey	Guildford [1]
	Mole	Dorking
	Darent	Sevenoaks
	Medway	Maidstone
South Downs	Arun	Arundel [1]
	Ouse	Lewes [1]

Coastal Features.—The most interesting coastal features are:

(1) Chalk headlands at North Foreland, South Foreland (*North* Downs), Beachy Head (*South* Downs).

(2) Dungeness, a natural "groyne" of shingle ridges, built by the tidal currents. Selsea Bill is very similar.

(3) Sands and banks in Thames Estuary. Many buoys and lightships to aid navigation.

(4) Goodwin Sands, formerly part of mainland, shelter the famous roadstead known as "The Downs." Large areas of the firm sand of the Goodwins are uncovered at low water.

(5) Isle of Thanet, bordered by chalk cliffs, once separated from the mainland by a deep channel (now silted up by the River Stour), has the well-known watering places of Margate, Ramsgate, and Broadstairs.

(6) Sandwich, once a port, is now useless as a harbour.

(7) The River Rother has silted up the old Portus Limanus of Roman days, creating Romney Marsh.

Climate, Productions and Industries.—This corner of England has long, warm, dry summers, a fair but not heavy rainfall, and rich fertile soil—all of which have made its cultivable lands famous for their heavy yields of fruit and hops. Kent is known as "The Garden of England." Apples, cherries, plums, pears, strawberries, currants and other fruits grow in abundance, and are sent by speedy transport to the London markets. A

[1] Castles.

familiar feature in a Kentish landscape is the "oast-house" or conical kiln in which the local hops are dried upon wire-netting or hair-cloth above a furnace, then packed in "pockets" or bags, to be used for brewing.

Wheat, root-crops, and dairy-produce are also characteristic of the rich Wealden lands. The slopes of the Downs afford pasture for sheep ("Southdown mutton"). In the map showing lands where most sheep are reared, the south-east corner of England is marked. (Fig. 27.)

From the foregoing it is evident that the main industries in the Wealden lands are agriculture and stock-rearing. In the fruit regions, gathering occupies many hands for nearly six months in the year—from June, when the strawberries are picked, to November, when apples and pears are gathered.

Before the Industrial Revolution the Weald was the chief seat of the English iron-industry (iron from the sandstones and charcoal from the forests), which was undoubtedly the chief cause of the partial destruction of the great Wealden forest. When pioneers like Roebuck and Darby discovered a cheaper method of smelting iron with coal, the iron industry naturally gravitated to the coalfields.

Building-stone from the hard greensand, chert for road-mending, fuller's-earth (Redhill) for removing grease from raw-wool, chalk, sand, clay and gypsum (near Battle) are the chief minerals of the Wealden lands. *Coal* is mined in deep pits on the Kentish coalfield in the near hinterland of Dover, but the yield has not been great as yet, although it is certain that large quantities are present. In the Shakespeare Pit a 22-inch seam was met with at 1273 feet; a 12-inch seam at 1477 feet; a 30-inch seam at 1500 feet; and a 27-inch seam at 1614 feet.

Towns and Communications.—This corner of England lies nearest Europe, and consequently contains our chief ferry-towns for the Continent. The routes are *Queenborough-Flushing*, *Dover-Ostend*, *Dover-Calais*, *Folkestone-Boulogne*, and *Newhaven-Dieppe* (see p. 228). All these are really outports of London.

Another important ferry-port during the war was *Richborough*, which was used as a great military transport depôt and was the English terminus of the train-ferry service with Calais, Dieppe and Dunkirk. Properly organised, Richborough can deal with traffic to the extent of 30,000 tons a week.

Since south-eastern England is mainly an agricultural region, its chief towns are nearly all market-towns situated at points where traffic naturally converges—*i.e.* at gaps in the chalk

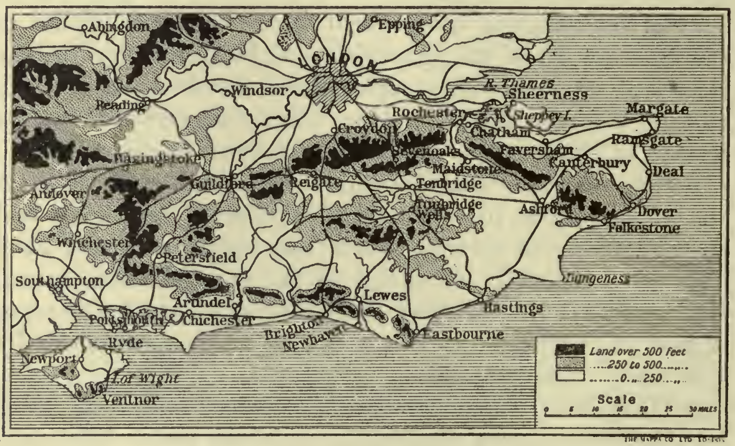

FIG. 58.—WEALDEN TOWNS AND RAILWAYS

Downs. *Maidstone*, *Reigate*, *Sevenoaks*, *Dorking*, *Guildford*, *Godalming* and *Canterbury*; *Ashford*, *Arundel* and *Lewes* are the outstanding examples. *Canterbury* is situated at a bridge-point on the Stour opposite a gap in the North Downs, and on the main route from London to Dover, where four important roads converge. It has the oldest cathedral church in England.

Maidstone, similarly, is at a bridge-point on the Medway, opposite another gap in the North Downs, where five important roads converge It has hop orchards and many paper-mills.

Guildford, in the Wey Gap, is a castle-town and market-town, as well as an important military centre, because it commands the main route by road and rail between London and Portsmouth and Southampton.

Rochester, another castle-town and cathedral city, is at the head of the Medway estuary, on which also are the naval dockyards of *Chatham* and *Sheerness*, its outport, which play an important part in the Thames sea-defences.

Gillingham, near Chatham, is the headquarters of the large traffic on the Medway.

Dover, our nearest port to the Continent, has a fine artificial harbour and strong defences. It is a naval port of considerable importance, and during the war was the headquarters of the fleet that guarded the Straits. Dover is one of the Cinque Ports (Hastings, Romney, Hythe, Dover and Sandwich), which played so important a part in the naval warfare of the Middle Ages. All the rest have dwindled in importance, owing to the silting up of their harbours and the increase in tonnage of ships.

South-eastern England is the warmest and sunniest part of the country in summer, especially on the coast, which has on the average from 1600 to 1800 hours of sunshine annually (Pennine Region only 1100 sunshine hours annually). It naturally follows that around the coast is a chain of popular seaside resorts—Herne Bay, Birchington, Westgate, Margate, Broadstairs, Ramsgate, Deal, Folkestone, Sandgate, Hythe, Hastings, St. Leonards, Bexhill, Eastbourne, Seaford, Brighton, Shoreham, Worthing, Littlehampton and Bognor. No other part of our coast can show so great an array of holiday resorts. *Brighton* is most popular and most important of all. Its nearness to London and its easy accessibility have caused it to grow enormously and to become (like Southend) a London suburb. It well deserves its title —"London-by-the-Sea."

Other towns of interest are *Dartford*, a small bridge-town on the Darent, with chemical works (Wellcome's), paper-mills and cement works, and the advantage of cheap transport by way of the Thames and its estuary; *Sittingbourne*, with great paper-mills; *Ashford*, at the entrance to the Stour Gap, with engineering works and hop-markets; *Strood*, where Charles Dickens lived, near Rochester, with cement works and engineering works (steam-rollers), and *Tunbridge Wells*, a health resort with baths and mineral springs.

Villages and Water.—A glance at a large-scale map will show that many Wealden villages lie along a line at the foot of the chalk escarpment. This is because of the springs which bubble up along this line from the chalk above the clays.

QUESTIONS AND EXERCISES

1. Explain by means of suitable diagrams (*a*) the peculiarities of Wealden drainage, (*b*) the sites of Wealden villages.

2. Distinguish between "wind-gaps" and "water-gaps," and give examples of each.

3. At one time the Wealden Area was of much greater economic importance than it is to-day. Explain why, and point out the conditions which have brought about the change.

4. Examine critically the sites of Chatham, Canterbury, Tunbridge Wells, Dover, and Dorking.

5. Which are the Cinque Ports? Discuss their past and present importance

CHAPTER XXIV

THE HAMPSHIRE BASIN, THE ISLE OF WIGHT, AND THE CHANNEL ISLANDS

THE Hampshire Basin consists of a great shallow dip in the chalk, partly filled with clays and sands like those of the London Basin. To it belongs the Isle of Wight, which formerly was part of the mainland, but which became separated from it by subsidence and by sea erosion. Spithead and the Solent, now deep channels of great value as roadsteads (protected by the high Isle of Wight), were formerly the valley of the great main east-flowing river into which the present streams of the Hampshire Basin flowed.

The flooding of this old valley resulted also in the creation of Southampton Water (the drowned lower valley of the Avon, Test and Itchen); of Portsmouth Harbour; and of Poole Harbour (the wide shallow lower valley of the Stour and Frome). A good geological map shows clearly the connection of the Isle of Wight with the mainland. The chalk of the Hampshire Downs dips below the Spithead-Solent roadstead, and reappears uptilted in the chalk backbone of the island. The Needles, off the western end of the island, are detached chalk masses forming part of the old link with the chalk ridge of Dorset which comes to the sea near Swanage. A famous lighthouse marks the Needles for ships coming up-Channel at night, and points the way to Solent and Southampton Water.

Other interesting coastal features farther west are (1) Lulworth Cove, a bottle-necked inlet formed by the sea breaking through a narrow belt of hard rock which lies parallel to the sea, and breaching a wide cove in the softer rock behind it.

(2) The Isle of Portland, linked to the mainland by "the most extensive and extraordinary accumulation of shingle in the world"—the Chesil Bank, which is some eighteen miles in length. Chesil "Bank," or Beach, is really a kind of natural groyne formed by the accumulation of pebbles swept before the flood-tide of the Channel. (A few miles farther east, at the Solent gate, is a similar but smaller shingle bank, known as Hurst Point.) The limestone of Portland Isle is quarried by the convicts of Portland Prison.

Relief and Drainage.—The basin is bounded on the landward side by the chalk uplands of Dorset, Salisbury Plain, the Hampshire Downs, and the South Downs.

From these chalk heights drain the main streams—the Frome and the Dorset Stour, the Salisbury Avon, the Test and the Itchen—most of them in fairly deep valleys. *Salisbury Plain* is a dry plateau some 400 of 500 feet above sea-level. It is well-known as a military centre for training troops. It is by no means level, but in many places has folds and dry valleys large enough to conceal considerable bodies of men. The chalk Downs bear many traces of the earliest civilisation in Britain in the "giants' graves," burial mounds, "camps," and old roadways and cattle-tracks of prehistoric times. On Salisbury Plain is ancient *Stonehenge*; near Avebury, in Wiltshire, is another famous "temple" or stone circle which is older still.

Climate, Productions, and Occupations.—The whole region, with its general slope towards the sun, has a mild genial climate which has given rise to the seaside resorts of *Bournemouth* and the Isle of Wight, and which makes these places peculiarly suitable for invalids who dread severe winters. Like the Weald, the Hampshire Basin was formerly densely forested. It was these forests which in ancient days supplied the timber for the ships built at Southampton and Portsmouth, and thus gave rise to the important modern ship-building industries at those places. The *New Forest* is a considerable remnant of these ancient forest-lands, and contains wide stretches of open heath and grass as well as some of the best forest in England. Another famous forest is *Savernake Forest*, which lies on the northern border of the basin.

The sheltered valleys with their rich alluvial soil and the clay and sand areas in the south yield grain, hops and fruit, as well as roots and rich dairy-produce. The Isle of Wight is Kent's rival for the title "Garden of England." Sheep are reared

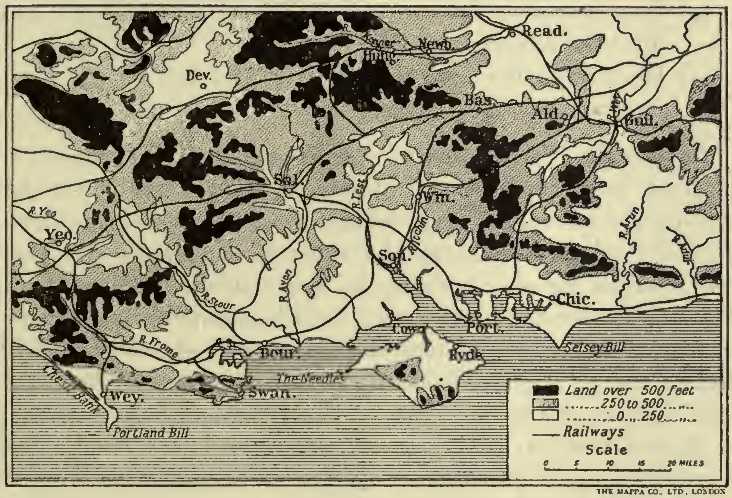

FIG. 59.—THE HAMPSHIRE BASIN: RELIEF AND ROUTES

on the Downs, and cattle in the rich meadows of the river valleys.

Towns and Communications.—The railways serving this area are (1) the London and South Western Railway main line from Waterloo *via* Woking and Basingstoke, where it branches (*a*) to Winchester and Southampton, Bournemouth, etc.; (*b*) to Andover, Salisbury and the west; (2) the London and South Western Railway *via* Guildford to Portsmouth, and thence by ferry to the Isle of Wight; (3) the London, Brighton and South Coast Railway along the coast from Brighton to Portsmouth.

Southampton owes its importance to:

(1) Its position at the head of a deep inlet which enjoys double tides. (See p. 6.)
(2) Its position at the seaward end of a great land-route which leads to London and the industrial midlands by road and rail.
(3) Its convenience for South African trade.
(4) Its convenience as a ferry-town for Havre and Paris, and for the Channel Islands.
(5) Its convenience as a military port, backed by the great military depôts of Aldershot and Salisbury Plain.

Portsmouth ("sister town" of Southsea and Gosport) is a great naval station and dockyard whose approaches are elaborately protected, and whose near roadstead, Spithead, provides splendid anchorage for ships of the Navy. The port was famous for ship-building in Tudor times, when a Royal Dockyard was established there. It still maintains its character as a naval dockyard, although most materials have to be brought from the coal- and iron-fields of the Midlands and the North.

Winchester, where the valley of the Itchen narrows, was once a Roman fortress; and Roman galleys, and later Saxon and Danish "long-dragons," were able to ascend the Itchen to its very walls. In Alfred's time Winchester was the capital of England. Its fine old cathedral bears in its architecture the history in stone of all periods from Norman to the present day. Like most large inland centres in this region, it is a market-town.

Weymouth, provided with a splendid naval harbour sheltered by artificial breakwaters and by the natural groyne of Chesil Bank, is the ferry-port for the Channel Islands and for St. Malo in Brittany. It is a seaside resort and a fishing-centre.

Salisbury is a confluence-town, cathedral-city and market-town.

Basingstoke, *Alton*, *Romsey* and *Petersfield* are small market-centres at gaps in the chalk.

Dorchester is an old market-town on the Frome, which enters the sea in *Poole* harbour, whence local white clay is sent by sea to the Mersey for use in the Staffordshire Potteries. *Swanage* and *Wareham* quarry building-stone and Purbeck marble.

Aldershot is famous as a military centre. *Devizes*, at the western end of the Vale of Pewsey—" a Weald in miniature "—is the market-centre for the vale. It stands on the watershed between the Vale of Pewsey and the Bristol Avon basin, and is thus a natural centre for the interchange of products of the two regions.

In the Isle of Wight are *Cowes*, a famous yachting centre, and *Ryde*, *Shanklin*, *Ventnor* and *Sandown*, all well-known holiday resorts.

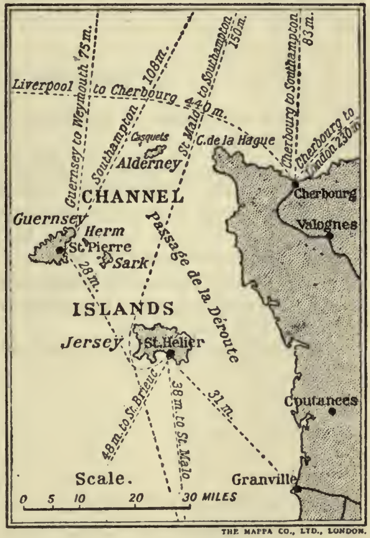

FIG. 60.—THE CHANNEL ISLANDS

The Channel Islands.—The Channel Islands, which have been English for many centuries, and are all that remain of England's once great continental possessions, belong structurally to France, in much the same way as the British Isles belong to the continent of Europe. A little north of them is the Hurd Deep, formerly the bed of the prehistoric Seine.

Their coasts are very rocky and rugged, and beset by sunken rocks. The sweep of the tides among the islands gives rise to dangerous currents—especially to the " Race of Alderney," a tidal current which runs eight miles an hour. But there are several useful harbours, notably that of St. Peter's Port in Guernsey and of St. Aubin's Bay in Jersey.

The climate is mild and very sunny. Frost and snow are uncommon. The islands have, in consequence, become famous for their supplies of early fruits, vegetables and flowers, most of which find their way to the English markets. Fishing is naturally an important industry. Alderney and Jersey cows are world-famous.

The chief towns are *St. Helier* in Jersey and *St. Peter Port* in Guernsey. The islands are famous holiday resorts, especially in spring.

QUESTIONS AND EXERCISES

1. Show by means of diagrams that the Isle of Wight was once part of the mainland.

2. Explain the geographical and strategic importance of Southampton, Portsmouth, and Winchester. (Give suitable sketch maps.)

3. Winchester was once the capital of England. What advantages made it so? Why is London a better capital for modern England than Winchester could possibly be?

4. A merchant living in Manchester wishes to spend his summer holiday in the Channel Islands. By what route will he travel, and what will his fare cost him (first-class)?

What attractions have the Channel Islands as a holiday resort?

CHAPTER XXV

EAST ANGLIA

East Anglia consists of the counties of Norfolk and Suffolk, if we are to take it in its original and historical meaning. But the region we have to study in this section is that which lies east of the chalk ridges of the East Anglian Heights and the Norfolk Heights, and includes a large part of Essex. It forms the northern portion of the great "London Basin." Both Norfolk and Suffolk have their extreme west in the Fenland, which is considered elsewhere.

From the chalk ridges sluggish rivers flow down across the clays, gravels and crag of East Anglia to the muddy estuaries which tempted the Saxon and Danish sea-rovers to raid inland. Large areas of country are thickly strewn with "boulder-clay" left by the retreating glaciers of the Ice Age, and together with the long, dry, warm summers explain the suitability of East Anglia for wheat-growing.

Coastline.—The coastline of East Anglia is remarkable for the rapid erosion of its cliffs of soft gravel and clays, and the removal southward by strong tidal currents of the débris, which in certain places has been deposited in the form of shingle-spits and sand-spits, with consequent important alterations in local geography.

The *Bure*, *Yare*, *Wensum* and *Waveney* in Roman times emptied into a wide estuary which became so silted up and barred by sand-spits that portions of it were converted into the wide shallow reedy lakes known to-day as "The Norfolk Broads." The rivers were thus forced to seek a new outlet southward. The *Alde* approaches within a quarter of a mile of the sea near *Aldeburgh*, then meanders south to its mouth twelve miles lower down, separated from the North Sea by a great spit of shingle fringed with marshes on its landward side.

Orwell and *Stour* unite to form *Harwich* harbour, a naval

FIG. 61.—EAST ANGLIA: RELIEF AND RAILWAYS

basin guarded by Landguard Fort at the end of the *Felixstowe* sand-spit. *Parkeston Quay*, the home of the Great Eastern Railway ferries to the Hook of Holland, Antwerp, Flushing and Esbjerg, is on the inner side of the harbour.

The *Colne* and the *Chelmer* (Col*chester* and Chelms*ford*) also enter the Thames estuary by muddy tidal estuaries. South of the Colne the encroachment of the sea, which is fast demolishing the coastline of East Anglia, ceases; on the contrary, land is being built up by the silt and mud and deposited by the Thames and its estuarine feeders, as well as by the southward-sweeping tidal currents.

Climate, Productions and Industries.—The climate of East Anglia is comparatively extreme in relation to the milder west. In many respects it approaches closely a continental marine type of climate. Summers are long and dry, and there is more sunshine and less rain than almost anywhere else in Britain. These climatic advantages, together with the widespread thick deposits of boulder clay, make East Anglia one of the most important wheat-growing regions in the British Isles. Norfolk and Suffolk have nearly 60 per cent. of arable land. The average for England is only about 33 per cent. There are no important mineral deposits, though boring for petroleum has been begun in Norfolk. Typical industries will therefore be agriculture and fishing, and wealth and occupations in East Anglia will naturally be founded on both. It was in East Anglia that improved farming methods discovered on the Continent were first tried in the British Isles. The old three-field system was replaced by a four-year rotation of crops, and the eastern counties thus became the richest part of England in the Middle Ages.

The heavier soils yield large crops of wheat; the lighter soils produce barley and oats; potatoes, peas, beans and general root-crops grow everywhere. There are many fruit-farms where raspberries, strawberries, currants, gooseberries and plums are grown for the London market and for jam.

The most important towns are necessarily market centres; and their manufactures, if any, are directly related to the needs of farms and farmers. *Norwich*, a castle town and cathedral city, still holds some of its old importance as a manufacturing centre in woollens, silks and leather. Woollens (especially worsted, from the village of Worsted near by) originally depended on local sheep-farms. The industry was founded by Flemish weavers in 1326, and stimulated by the immigration of 5000 Dutch and Walloon refugees in 1582; and extended to the silk weaving (crape). To-day, boots and clothes for the farmers, agricultural implements for farms and market gardens, starch and mustard (from local crops) and silk are its chief manufactures.

Ipswich, at the head of the estuary of the Orwell, is growing in importance as its docks are developing. Its connection with local agriculture is also seen in its manufactures: agricultural implements, flour, boots and clothing. It is an important wheat market, and the chief junction on the Great Eastern Railway, where lines meet from Norwich, from Yarmouth and Lowestoft, and from London.

Thetford makes traction engines. *Stowmarket* (explosives) and *Bury St. Edmunds* make agricultural implements. *Colchester* is famous as a military centre, as an old Roman town, and as a market centre. It is noted for its oysters which are dredged from the rich estuarine oyster-beds between Colchester and Maldon.

Chelmsford (a bridge-town) is a market centre. Like Colchester it is built on dry sands and gravels above the boulder clay, where copious supplies of good water are assured.

Sudbury, in Suffolk, manufactures silks; so does *Braintree*, in Essex.

East Anglia is famous for its *fisheries*, especially of herring, sprats and cod. The chief centres are *Yarmouth* and *Lowestoft*, where large industries have been developed in curing, smoking and packing fish. Canneries originally established to pack fish have developed general meat-packing also. In the herring season, large numbers of hands are specially imported from Scotland to deal with the heavy catches. Great quantities of salt fish are exported to countries where religious observances demand periodical abstinence from meat.

Ports and Holiday Resorts.—*Harwich* is one of the great naval stations for the east coast, and the chief packet station for the Hook of Holland, Hamburg, Antwerp, Flushing, and Esbjerg.

The Harwich—Hook of Holland route is the shortest way to Berlin and Middle Europe. *Dovercourt* and *Felixstowe* are seaside resorts close by.

Yarmouth "roads" is the best roadstead between the Humber and the Thames. The town, with its suburb of *Gorleston*, is a famous holiday resort.

All along the coast of East Anglia from the Thames estuary to the Wash are numerous spots beloved of holiday-makers from London—Southend, Clacton, Walton, Aldeburgh, Southwold, Lowestoft, Mundesley, Cromer, Sheringham, and Hunstanton, for examples. Their attractions make traffic on the Great Eastern Railway very heavy in the holiday months of the year.

QUESTIONS AND EXERCISES

1. Summarise the main facts which can be gathered from the following table:

County.	Arable Land per cent.	Percentage under			
		Wheat.	Barley.	Oats.	Roots.
Norfolk . .	59.5	9.2	14.4	5.8	13.4
Suffolk . .	59.5	11.7	12.6	5.0	8.3
Essex . .	51.8	13.1	6.3	6.5	5.3
Kent . .	30.5	4.9	3.1	4.5	4.3

2. Explain the chief facts shown in the following table:

County.	Area. 1000 Acres.	Per 1000 Acres.		
		Cattle.	Sheep.	Pigs.
Norfolk . .	1,315	10	31	8
Suffolk . .	948	8	31	7
Essex . . .	979	9	19	7
Kent . . .	976	9	89	6

3. Draw a sketch map of the area served by the Great Eastern Railway. Name the chief towns, underlining market towns in black, fishing centres in green, and seaside resorts in red.

4. " Many East Anglian towns are bridge-towns. The largest became important because of their position on the great main roads."

Discuss and illustrate this statement.

5. Explain the comparatively dense population of East Anglia in the Middle Ages.

In what ways may East Anglia be said to have made history?

6. " At Brandon in Suffolk there exists what is probably the oldest manufacturing industry in Britain." Explain this.

CHAPTER XXVI

THE CLAY TROUGH AND THE FENLANDS

BETWEEN the long escarpment of the chalk and the dip-slope of the oölite is a great trough of clay—sometimes divided by ridges of sandstone or limestone into smaller parallel valleys—stretching from the Vale of Blackmoor in the south to the Humber and the Wash, and terminating in the Fens.

It can be traced on the orographical map through the Vale of Blackmoor, the upper valley of the Bristol Avon, the Vale of White Horse, and the Vale of Aylesbury, to the edge of the Fenlands which almost surround the Wash. In the Vale of Oxford to Aylesbury it includes the basin of the upper Thames.

Productions and Occupations.—The whole of the region is mainly agricultural in type; but in the last 150 years much arable land has been turned into pasture, and dairy-farming has become the most important industry, instead of wheat-farming. In spite of this fact, however, the clay trough still contains some of the most important grain-growing areas in the British Isles.

Hence towns will be chiefly market centres, and their manufactures, if any, will be such as meet the needs of a farming population; or such as depend upon, or had their origin in, the produce of field and farm. Typical market centres are Oxford, Aylesbury, Buckingham, Huntingdon (cheese, fruit and dairy produce), St. Ives, Cambridge, Peterborough (wheat), Grantham, Lincoln, Horncastle (horses), Boston (a port also), Spalding, Ely, March, and King's Lynn. *Devizes* is the natural market centre for the rich Vale of Pewsey and the upper Avon. *Newmarket,* on the chalk "downs" of the East Anglian Heights, has become a great racing centre and horse-rearing centre (*cf. Epsom*, in a similar situation).

The fine long wheat-straw and pure water supply of Bedfordshire gave rise to the *straw-plaiting* industry of Dunstable, Luton, Bedford, Hitchin and Bletchley, and to cardboard and paper industries. But local supplies of raw material no longer support these industries, and large quantities of straw-plait are imported—*e.g.*, from China and Japan. The tendency of industries to persist in places where they arose out of local conditions, in spite of the fact that those conditions no longer exist, is known as *Industrial inertia.* Another example is the leather industry centred at Northampton.

The *leather industry* originally depended upon the hides of the cattle reared in the clay trough and the Midland plain, and in the valleys of the oölite. *Northampton,* at the navigation-limit of the Nen, is the chief boot and shoe manufacturing centre in Britain. *Kettering*, *Wellingborough*, *Higham Ferrers*, *Oakham*, *Daventry*, and many neighbouring villages are engaged in the industry.

The *woollen* industry of the Upper Thames Basin (*e.g.* blankets at Witney) owed its origin to local wool from the oölite sheep pastures, and abundance of clear water.

Iron-working in this region—*e.g.* at *Westbury* in Wiltshire, at *Wellingborough*, *Oakham* and *Kettering* and other places—depends upon the iron ore found in the oölite.

The clays near *Peterborough* have given rise to important brick-making industries.

The *beech-forests* of the Chilterns have given rise to the famous chair-making industry at *High Wycombe*, *Wendover* and neighbouring villages.

The excellent *building-stones* of the oölitic belt have led to extensive quarries in Portland Isle; near Yeovil; near Wells and Bath; and at *Barnack* (Northampton), *Ketton* (Rutland) and *Ancaster* (Lincoln). Good roofing-stone occurs at *Stonesfield*, near Oxford; it has been used for roofing the Oxford cottages.

Agricultural machinery is manufactured at many towns and market centres: *e.g.* at *Lincoln*, *Peterborough*, *Bedford*, *March*, *Huntingdon* and *St. Ives*.

Swindon, the great locomotive and repair centre and junction of the Great Western Railway, stands near the watershed of the Thames Basin. *Bedford* has important engineering works; and so has *Peterborough*, an important railway centre and market town.

Universities and Cathedral Cities. — In the clay trough are situated the famous university towns of *Oxford* and *Cambridge*.

Oxford stands on a gravel cap above the clay between the Thames and Cherwell, at the centre of the great fertile plain forming the basin of the Upper Thames. It was as a market centre that Oxford first became important (*cf.* Cambridge); and its university, like that of Cambridge, grew up partly because of the agricultural wealth of the region and its ability, in the Middle Ages, to support a fairly dense population.

Cambridge commanded the ridge of "downland" which in early times formed the only means of communication between East Anglia and the Midlands. To the north of this ridge lay impassable fenland; to the south of it impenetrable forest. The town stood at the head of a waterway, giving direct access to the sea, and so to the continent. Cambridge thus became the chief distributing centre of eastern England; and its growing trade led to the establishment of a fair which later became one of the chief in Europe. "Cambridge became the seat of a great English university because it had already become a chief centre of English trade." Bookbinding and printing industries are carried on. On the outskirts of the town are cement and brick works. *Histon*, close by, is the centre of a great jam and fruit-canning industry. *Sawston* makes parchment, fine paper, and "chamois leather."

The chief cathedral cities in the region are *Lincoln*, *Ely*, *Peterborough*, *Oxford*, *Bath* and *Wells*. The large number of monasteries, abbeys and cathedrals that arose in the clay trough during the Middle Ages testify to the extraordinary fertility of the region.

The Fens and the Wash.—The Fens have been called "the

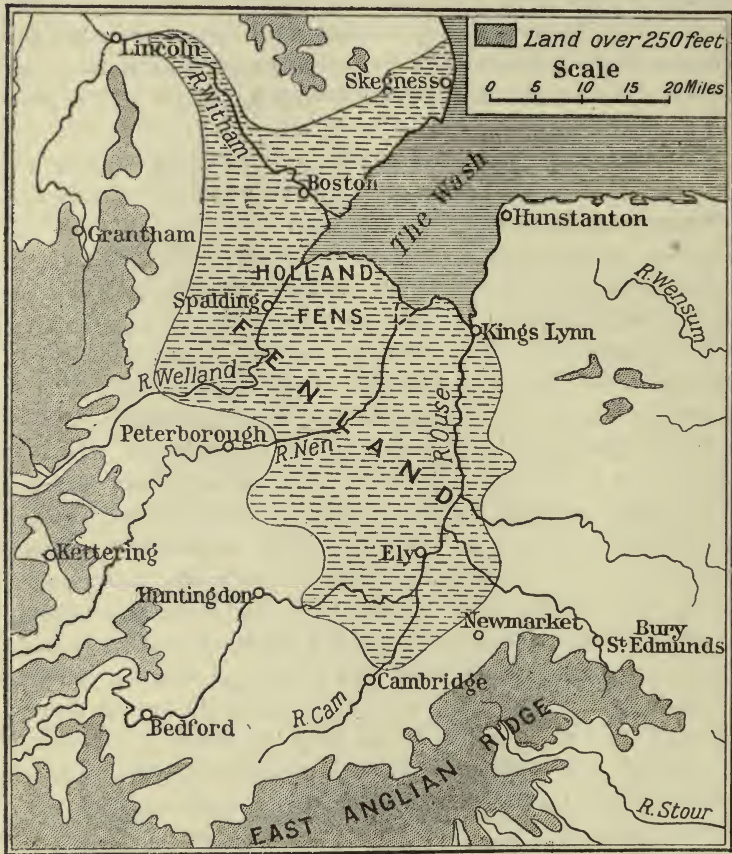

FIG. 62.—THE FENLANDS AND THE BASIN OF THE WASH

delta of the rivers of the Wash"; but a great deal of the fine silt which covers them has been swept inland by tidal currents and not brought down by the rivers themselves.

The seaward edge of the Fens is the *Wash*, a wide shallow inlet formed by the invasion of the sea in former times through a great breach in the chalk. To-day, the sea-tide which formerly invaded the fenlands, turning them into a broad sheet of shallows and swamps, is kept back by a series of embankments comparable with those of Holland. Formerly the Fens extended inland to Cambridge and Huntingdon, Peterborough and Lincoln, but extensive drainage schemes (like that of the famous Bedford levels), the establishment of pumping machinery, the straightening and canalisation of parts of the rivers, have now reclaimed most of the Fenlands. Scientific farming has made much of the old Fenland an agricultural region unequalled for fertility anywhere in England; and Cambridgeshire has a higher percentage of arable land than any other English county. The earliest settlements in the Fens grew up on low hills—really islands—above the general flood-level. *Ely*, *Ramsey*, *Whittlesea*, all bear in their names the record of their " island site." (" Ea " or " y " = island.) At the old edge of the Fens stand Huntingdon, Peterborough, and St. Ives, Cambridge and Bedford.

With the draining of the Fens grew up small ports at or near the mouths of the rivers: *e.g. King's Lynn*, on the Ouse; *Wisbech*, on the Nen; *Spalding*, on the Welland; and *Boston* on the Witham. Of these Boston attained some little importance; but the continued silting up of the Wash and its navigable channels, and the increase in size of ships, soon put an end to the development of Boston and its sister ports. The *Witham* is interesting because, unlike the other Wash rivers (which are typical " longitudinal streams," following the tilt of the clay trough), it has cut a gap through the Lincoln Heights—a gap commanded by the city of *Lincoln*, which since Roman days has been an important route-control centre. Along the oölite ridge of Lincoln Edge the Romans carried Ermin Street (London-York), founding *Lindum Colonia* in the river-gap. To-day the Great Northern Railway from London, the Midland Railway from Nottingham, the Great Northern Railway and Great

Eastern Railway from Doncaster to Cambridge, and the Great Central Railway line to Grimsby and Immingham Docks pass through the Lincoln Gap of the Witham.

Grimsby, the great fishing centre whose fleets fish the "Dogger," carries on not only a large export trade in fish, but also in the woollens and cottons of the great industrial regions which lie behind it. It ranks as the seventh port in the British Isles. Its excellent rail communications with the densely-populated manufacturing areas of the Midlands and the North and with London, bring its fish products in direct and swift touch with profitable markets.

Immingham Docks, near Grimsby, are the docks of the Great Central Railway route to Scandinavia and the Baltic. Immingham is one of Britain's new "deep-sea" ports, and is growing rapidly.

Along the Lincolnshire coast are several popular seaside resorts, *e.g. Skegness*, *Sutton-on-Sea* and *Mablethorpe*.

QUESTIONS AND EXERCISES

1. Comment fully on the following table:

County.	Arable Land. Per cent.	Under Wheat. Per cent.	Under Barley. Per cent.	Under Oats. Per cent.	Under Roots. Per cent.
Cambridge .	67.8	18.0	10.2	8.0	11.2
Huntingdon .	52.1	14.2	9.0	3.9	6.3
Bedford . .	47.7	12.5	4.2	6.6	5.8
Lincoln . .	58.6	9.3	12.5	6.9	11.7
Kent . .	30.5	4.9	3.1	4.5	4.3

2. Contrast the Fen country of the days of Hereward the Wake with the Fenland of to-day.

3. Explain what is meant by "industrial inertia," and give examples of its operation.

4. A great fruit-growing industry has developed in the Fenlands. What conditions favour its growth?

5. Examine the sites of Boston, Cambridge, Huntingdon, Ely and Oxford. Illustrate your answer by sketches.

CHAPTER XXVII

THE SOUTH-WESTERN PENINSULA

WESTWARD beyond the Mendips and the Dorset Heights lies the south-western peninsula and the Plain of Somerset, including Cornwall and Devon and most of Somersetshire.

Surface Relief.—The outstanding features of surface relief are the sandstone heights of *Exmoor* (highest point, Dunkery Beacon) and the old granite mass of *Dartmoor* (Yes Tor, 2028 ft.), separated by the Vale or Plain of Devon through which the Taw and Torridge flow north to Barnstaple Bay, and the Exe to the English Channel.

West of Dartmoor lies the deep cleft of the Tamar Valley, with its drowned lower part forming Plymouth Sound; and beyond rises the granite " boss " of Bodmin Moor, with other granite masses farther west at St. Austell, Redruth and Land's End. Across the Exe from Dartmoor are to be seen the greensand Blackdown Hills which are separated from Exmoor by the Vale of Taunton, in which lies the Great Western Canal linking Taunton and Tiverton.

The coast is as a rule high and rocky, save where the flat plain of Sedgemoor comes down to the sea. Cliff scenery, and drowned river valleys forming *rias* or deep estuaries are characteristic (Harbours of Falmouth and Fowey, Plymouth and Dartmouth). The Scilly Isles are the upstanding remnants of an old land area, now submerged. Land's End is a granite mass; the Lizard is composed of serpentine. Lundy Island, off Barnstaple Bay, is a volcanic mass.

Two Interesting Types of Scenery.—In this corner of England are two interesting types of scenery, which are chiefly the result of the character of the rocks. In the Mendips, the remarkable features of *limestone* scenery are apparent. Magnificent crags, steep cliffs and deep gorges have resulted from the weathering of the limestone. The Cheddar Gorge is famous for its picturesque scenery. (The Avon Gorge, near Bristol, the Wye Valley, and the Peak District are other limestone regions famous for their remarkable scenery.)

Rainwater percolates through limestone, dissolving it out, widening fissures, and hollowing out channels and caverns in the rock. Some streams in limestone regions disappear down "swallow-holes" or "swallet-holes" formed in this way, and after a long journey underground emerge from some cleft or cavern which may be miles from the spot there they left the sunlight. The famous Cheddar Caverns owe their origin to underground streams. They are remarkable for the variety and beauty of their stalactitic and stalagmitic formations. The Cheddar Gorge itself is thought to be the weathered-out channel of an ancient stream which flowed through a prehistoric cavern, whose roof collapsed, forming the gorge. (Limestone scenery is sometimes termed *Karst* scenery, or Karst phenomena, from the scenery of the Karst lands of Dalmatia.)

Dartmoor affords excellent examples of the type of scenery that results from the weathering of *granite*. The granite weathers down into huge rectangular blocks many of which are known as *Tors*. Great Links Tor (2039 feet) is the highest point on Dartmoor.

It is from the weathering of this ancient granite that *Kaolin* or china clay has been derived. The Kaolin was formerly collected from natural pockets or hollows into which it had been washed by natural drainage. To-day most of it is obtained by artificial methods of collection.

Climate, Products and Industries.—The climate of the south-western peninsula is the most equable in Great Britain, for it has a long coast-line and it receives the full effects of the warmth and moisture brought from the warm North Atlantic by the prevalent westerlies. The mean annual range of temperature is only from 16° F. to 18° F. In Surrey it is 24° F. Rainfall in Cornwall is from 40 to 60 inches. On Bodmin Moor it is heavier still—from 60 to 80 inches. The mildness of the climate is well illustrated by the fact that in the gardens at Penzance palms and bamboos and other sub-tropical plants flourish, and hydrangeas and other delicate flowers grow in the open air.

The region is famous for its holiday resorts—*Torquay*, the "English Naples," Penzance, Ilfracombe, Lynton and a score of smaller coast towns, especially along the "Cornish Riviera." The Scilly Isles and Cornwall send early fruit, flowers and vegetables to London markets. Good prices make it profitable in spite of heavy carriage costs. In the rich alluvial valleys and plains cattle and horses are reared, and orchards of apples and pears flourish. Devonshire cream and cider, and Cheddar cheese are world-famous.

The fenland region of Sedgemoor at the foot of the limestone Mendips is splendid grazing land for cattle. Butter, cheese, milk and eggs are produced in large quantities for the British area. Peat is dug on Sedgemoor. A peculiar feature of this region is the presence of steep and almost conical hills, rising like islands here and there above the plain, *e.g.*, *Glastonbury Tor*, the reputed Island of Avalon where King Arthur went to be healed of his wounds. *Athelney* and *Wedmore* recall the struggle between Alfred the Great and the Danes.

Fishing is an important industry. The many coves and harbours along the indented coast-line shelter little fishing fleets. The pilchard and mackerel fisheries of Penzance, Newlyn, Newquay, St. Ives, Falmouth and other places are highly productive, the value of the fish landed at *Newlyn* and *St. Ives* alone being more than that of the catch for the whole of the rest of the south-coast fisheries of England. Plymouth and Brixham are famous trawling centres.

Home industries in lace, gloves, clothes, etc., naturally developed in this region, where, before the building of railways, the villagers had to produce everything they needed. They still survive in the lace work of *Honiton* and *Tiverton. Crediton* has a leather industry. *Mining* in the south-western peninsula has been carried on from very early times, but the mines are much less productive than formerly. *Tin, copper, lead, zinc, tungsten* and other metal ores are found in veins among the slaty

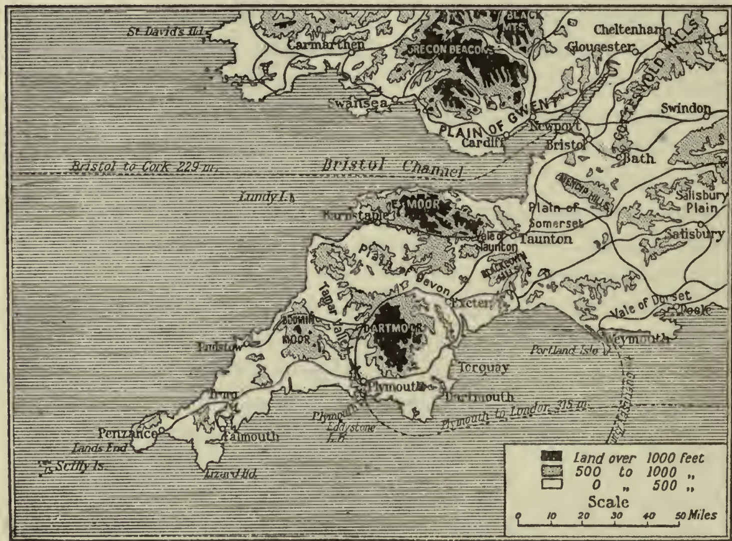

FIG. 63.—THE SOUTH-WESTERN PENINSULA: RELIEF AND ROUTES

rocks in the margins of the granites. Tin-mining is still carried on at Truro, St. Just and Bodmin, and most of the ore is sent to the South Wales coalfield to be smelted, though smelting is still carried on at Redruth, Truro and Camborne by means of imported coal. *Tungsten* (or wolfram), formerly a waste product of the tin-mining, is in great demand for hardening steel. It is separated out by means of powerful electro-magnets. *Lead* is mined in the Mendips, where it has been worked since Roman times; and in the basins of the Teign and Tamar.

Pitchblende, from which *radium* is extracted, is obtained at the Trenwith mine near St. Ives. Dynamite and other explosives are made in factories near Hayle, Perranporth and St. Ives. Granite and slate are quarried. Penryn granite and Delabole slate are famous.

Kaolin, or china clay, is most abundant around *St. Austell* and *Bodmin*, and on Dartmoor. It is exported from Fowey, Teignmouth, Charlestown, Par and Padstow. Some goes to the Potteries for use in making china; and some to Manchester and the cotton towns for use in stiffening and bleaching calico—by way of the Mersey. A little goes to Paris, where it is used in making confectionery ; and some even goes to the United States for use in making artificial teeth! China clay is also used in the paper-making industry for glazing paper that is to have pictures on it.

Chief Towns and Communications.—The chief railways serving the south-western peninsula are the Great Western and the London and South-Western. The Great Western main route from London meets at *Taunton* another line from Bristol (round the western Mendips). From Taunton two routes pass:

(1) The main G.W.R. *via* Exeter, Plymouth, the Saltash Bridge, and Truro to Penzance.
(2) An important branch of the G.W.R. to Barnstaple and Ilfracombe.

The London and South-Western from Salisbury runs to Exeter, and passes *north* of Dartmoor *via* Tavistock to Plymouth.

Plymouth, forming with Stonehouse and Devonport the "Three Towns," is the biggest city. Devonport is a great naval station, commanding the Channel entrances (*cf.* Portsmouth); Plymouth is a great mail and passenger port (*cf.* Southampton), and a calling place for liners on the Far East run. Plymouth Sound, sheltered by its famous breakwater, is a fine harbour upon which converges the traffic from a number of inland routes. The Eddystone Lighthouse stands far out at sea, the "sentinel of Plymouth," and the safeguard for ships steaming up-channel between Lizard and Start Point.

Falmouth, also on the drowned river-mouth of the Fal, is a fishing port and shipping centre.

Exeter, on the Exe, is an old Roman town and cathedral city, at the convergence of valley-routes. It is the county-town of Devon. *Bodmin* is the assize-town of Cornwall. *Truro* is a railway centre; so is *Taunton* which commands the main route into Devon. *Honiton* makes Axminster carpets as well as lace. In Somerset, the pretty cathedral city of *Wells* lies at the foot of the Mendips. On the coast are *Weston-super-Mare*, *Clevedon*, and other seaside towns. *Bridgewater* is a little port on the Parret, to which come coal and iron goods from the South Wales area.

QUESTIONS AND EXERCISES

1. Draw a sketch to illustrate the relation between Dartmoor and the railway routes of the region.

2. Show by means of a curve or other diagram the main facts you learn from the following table.

China Clay Exports

Year.	Tons.	Value.
1913 . . .	629,702	£743,430
1919 . . .	286,578	£762,939
1920 . . .	495,790	£1,450,605

3. Explain why Cornish tin is now less important to Britain than formerly.

4. Draw diagrams to show the geographical importance of Plymouth, Exeter, Taunton and Truro.

CHAPTER XXVIII

WALES AND THE COUNTY OF MONMOUTH—I

The mountain-land of Wales, the refuge of those Celtic peoples driven westward by successive waves of invaders—Roman, Saxon, Dane and Norman—has to-day an entirely artificial political boundary. In ancient days its eastern frontiers were determined by the lines of Offa's Dyke and Watt's Dyke, which can still be traced for many miles.

The county of Monmouth, although politically English since the reign of Henry VIII., belongs geographically to Wales and is therefore included in this section.

Relief and Drainage.—The Principality of Wales is filled with mountains, save for a narrow coastal plain in the north and west, and a wider coastal plain in the south (Plain of Gwent). Like the mountains of the Highlands of Scotland and the Lake District of England, the Welsh mountains are old plateaux dissected by streams which have carved it into valleys and ridges and blocks.

Look at the map and distinguish the following mountain masses:

(1) *Snowdon Range*, with its continuation, Bardsey Island.
(2) *Berwyn Range.*
(3) *Plynlimmon*, *Myndd Bach* ("little mountain") and the *Clun* and *Radnor* Forests.
(4) *Brecon Beacons* and *Black Mountain.*

Associate correctly with these:

(1) The sunken rift of *Menai Strait* at the foot of the Snowdon Range.

(2) The *Vale of Bala* (Der Valley) containing Lake Bala, between Snowdonia and Berwyn.
(3) The *Vale of Powys* (Severn Valley) between Berwyn and Myndd Bach—Clun Forest.
(4) The *Valley of the Wye* (flowing east) and the *Valley of the Towy* (flowing west) separating Myndd Bach and Radnor Forest from Brecon Beacons and Black Mountain.

All these valleys form important natural routes into and through Wales, and are followed by roads and railways. Notice how:

(1) *Chester* commands routes (*a*) along the northern coast-plain, and (*b*) up the Dee Valley.
(2) *Shrewsbury* commands the main route into central Wales, *via* the upper Severn Valley.
(3) *Hereford* commands the route up the Wye and down the Towy Valleys, as well as another important route, *via* Brecon to Swansea.
(4) *Gloucester* commands the route along the Plain of Gwent to the west.

All these towns are castle-towns, where the Lords Marchers of mediæval times kept watch and ward over the border. Along most of the routes above mentioned, castles were built to maintain the English King's peace among the Welsh.

Surface Relief and History.—The mountain region of Wales, long isolated from the changes that were welding Saxon, Dane and Norman into a nation, retained its own language and independence until the first Edward conquered and settled it.

To-day the Welsh nation retain all their sturdy independence of character; and Welsh is spoken widely, so that in most schools instruction is given in both Welsh and English.

The Welsh long resisted invasion because their mountain fastnesses enabled them to wear out would-be conquerors by a deadly guerilla warfare. But these same mountains proved their undoing, because:

(1) They prevented real union among the Welsh tribes.
(2) Their intersecting valleys enabled the country to be conquered piecemeal.

It is significant that the most convenient "central point" for meetings and conferences of Welsh people is *Shrewsbury*, a town in England! There is in Wales no central point on which the Welsh valleys and routes converge; and thus Wales has never had a capital. The mountains of Wales, says Sir Owen Edwards, "explain its isolation, and its love of independence; they explain its internal divisions; they have determined throughout its history, what the direction and method of its progress were to be."

The Isle of Anglesey, in sharp contrast to the mainland of Wales, has only one small elevation, Holyhead Mountain, above 500 feet. Though not now a particularly fertile region, its importance in early British times for grain cultivation gave it the title "Mother of Wales."

Wales has many lakes: most of them occur in rock-basins scooped out by prehistoric glaciers. The largest is Bala (Llyn Tegid), four miles long, formed by a morainic dam across the valley. Other well-known lakes are Padarn and Peris, near Llanberis, and Ogwen and Idwal in Nant Ffrancon. Two great English cities are dependent for their water supply upon the clear waters of the Welsh mountains.

Liverpool gets its water from the *Vyrnwy* reservoir made by damming the valley by means of a giant dam. Some 20,000,000 gallons pass along the 70-mile pipe line to Liverpool every summer day.

Birmingham has made similar use of the *Elan*, in the Wye Valley, where a reservoir has been constructed for the needs of its inhabitants.

Coastline.—The shore of Bristol Channel is generally low, broken by the mouths of the Usk and Taff, and by Swansea and Carmarthen bays.

THE MAPPA CO., LTD., LONDON.

FIG. 64.—WALES: RELIEF, ROUTES AND COALFIELDS

Pembroke has the splendid land-locked harbour of Milford Haven, twenty miles long, and big enough to shelter the whole British fleet. On its southern shore is Pembroke Dockyard, opposite New Milford. North of Milford Haven is the wide St. Bride's Bay.

The great sweeping curve of Cardigan Bay is generally high and rocky, with mountains overlooking the sea, and broken by the estuaries of the Teifi, Dovey and Mawddach.

Beyond the Menai Strait the coast rises again into bold cliffs and headlands (St. Orme's Head). The Dee estuary, a famous harbour in Roman and Saxon times, is now so silted up that Chester quays are accessible only to small vessels.

Climate and Farming.—Like western Scotland, Wales rears its highlands athwart the track of the prevalent wet westerlies, and has therefore a mild and moist climate, although the high average elevation results in severe winters and heavy snows in the upland regions.

Study the following table, and account for the facts:

Place.	Jan. Temp.	July Temp.	Range.
St. David's . . .	41.5°	58.5°	17°
Pembroke . . .	42°	60°	18°
Cardiff	40°	62°	22°
Holyhead . . .	42°	60°	18°
Greenwich . . .	38°	63°	25°
Rugby	36°	60°	24°
Yarmouth . . .	37°	60°	23°
Ramsgate . . .	39°	63°	27°

The average rainfall for Wales is about 40 inches. North Wales, and the upper Rhondda Valley in the south, have over 80 inches. Contrast these figures with those for south-eastern England in the same latitude—from 20 to 25 inches annually.

Since so much of Wales is mountain-land, farming on a large scale is impossible. It is estimated that about 19 per cent. of the country is under crops, and that about 42 per cent. is pasture;

the rest is unproductive. It is thus easy to see why Wales was until recently a poor country, and why she suddenly became important when her rich coalfields began to be exploited.

Oats, the grain that stands the vagaries of climate best, are most widely grown; next comes barley, then far behind come wheat and potatoes. Since the arable land is mainly confined to narrow valleys, save on the southern coastal plain, farms are small—about 17 per cent. of them being less than five acres. From North Wales, especially the rich Vale of Clwyd, strawberries and mushrooms are sent to the industrial areas of Lancashire and the Midlands.

The rearing of sheep and cattle is an important industry. Sheep-rearing on the slopes has led to the growth of woollen industries—as a home industry in Carmarthen, Merioneth and Cardigan, and as a factory industry in Newtown, Welshpool, Dolgelly, Llanidloes and other valley towns (Welsh flannels and blankets).

Cattle-rearing in the valleys and plains fosters a flourishing dairy industry, especially in Anglesey, Flint, Pembroke and Carmarthen, which supply cheese, butter, milk and eggs to the densely-populated industrial areas of South Lancashire and the Midlands.

Welsh ponies, a small and sturdy breed, are reared in the south; and large numbers of pigs are bred in Carnarvon, Montgomery, Denbigh and Brecon and in Pembroke and the dairy counties.

Fishing is carried on around the coast, principally for herring and mackerel. Welsh rivers are famous for their salmon. Oysters are dredged in the bays of the south-west and at Beaumaris.

Mineral Wealth: Coal.—It is upon her mineral wealth that modern Wales flourishes—especially her rich deposits of coal. The two chief Welsh coalfields are the South Wales coalfield, which is by far the more important; and the small coalfield of Flint and Denbigh.

The South Wales Coalfield, though not the largest, is perhaps the most important in the world; Welsh smokeless coal holds the field in the international markets. It extends over 1000 square miles, in the counties of Glamorgan, Brecon, Carmarthen, Pembroke and Monmouth (The Forest of Dean coalfield in Gloucester is an outlier of it). It produces a wide range of types and qualities of coal. West of Carmarthen the coal is pure anthracite. In the centre both steam coal and anthracite are found; and in the east bituminous coal for ordinary house and factory purposes. The South Wales coal measures are estimated to be upwards of 7000 feet in thickness. In the east the total thickness of the seam is 99 feet; in the west 182 feet of coal in 82 distinct seams occur. Lord Merthyr has estimated that the present average output can be maintained for nearly 640 years. In February 1921, 266,456 people were employed on this coalfield, and in that month the total amount of coal raised was 2,707,000 tons. The total production for 1912 was 47,100,000 tons.

Cardiff, Newport and Swansea, the chief outlets, export much more coal than all other British ports put together. Some idea of the vastness of this export trade in coal may be gathered from the following table.

Port.	Millions of Tons.		
	1913.	1919.	1920.
Cardiff . . .	19½	12½	9½
Newport . . .	4¾	3¾	2¾
Swansea . . .	3½	2½	1¾
Port Talbot . .	2¼	1½	1½
Llanelly . . .	¼	¼	½

The decline in the trade was due to the results of the war and industrial disputes.

The four leading foreign customers for this coal, in order of importance, were France, Italy, Egypt and the Argentine. The coal measures of South Wales lie in a vast basin formed by the old red sandstone, above which occur in order the carboniferous limestone, the millstone grit (both outcropping around the edge of the basin), and the coal measures. In the south the coal measures are invaded by the sea; Swansea Bay cuts right into the coalfield, bringing tidal water within touch of the coal. The South Wales coalfield has also the advantage that a large number of streams have cut valleys in it, which form natural routes for numerous railways that bear the coal to the ports, or metals from abroad to the smelters on the coalfields.

The South Wales coalfield supports vast metal industries, some details of which are given in the next chapter.

Other Minerals.—*Building stone* is abundant. The most important is slate, about 80 per cent. of which is quarried in Carnarvon and Merioneth at the famous quarries of Bethesda, Llanberis, and Blaenau Festiniog. The chief export centres are Carnarvon and Bangor.

Iron ore occurs in large quantities, but for many years iron-masters in South Wales have had to import foreign ores from Spain and Sweden because the local ores have become too difficult and too expensive to "win."

Copper is mined in small quantities in the north, *lead* (with silver) in Flint, and *zinc* in several counties. A little *gold* is found in Merioneth. But the metal ores which supply the great South Wales smelters come chiefly from abroad—*e.g.*, tin from Burma and the Straits Settlements; copper and iron from Spain; and nickel from Canada.

Aluminium is extracted from its ores at Dolgarrog in North Wales, where cheap water power is available.

QUESTIONS AND EXERCISES

1. Explain the following figures, and illustrate them by constructing a diagram.

Country.	Acres 100,000	
	Total Area.	Arable Area.
Wales . .	47	9
England . .	324	115

2. Illustrate, by reference to the South Wales area, the conditions most favourable to (*a*) a great iron and steel industry, (*b*) a great ship-repairing port.

3. The following is a chemical analysis of a typical specimen of good Welsh anthracite:

Carbon	92.73
Hydrogen	3.37
Oxygen and Nitrogen	2.69
Sulphur	0.45
Ash	0.76

Express this in the form of a diagram if you can. What can be learnt from the figures as to the value of this type of coal?

4. An expert writing in *The Times* of 18th December, 1920, gives the following figures relating to the extent of the South Wales coalfield. Draw a diagram to show the facts. Say what can be learnt from it.

Monmouthshire	104 square miles.
Glamorgan	518 ,, ,,
Breconshire	74 ,, ,,
Carmarthenshire	228 ,, ,,
Pembrokeshire	76 ,, ,,

CHAPTER XXIX

WALES AND THE COUNTY OF MONMOUTH—II

A GLANCE at the population figures for the British Isles shows that in South Wales is concentrated over five-eighths of the total population of the Principality. Glamorgan alone contains very nearly half the total population of Wales; and the city of Cardiff itself has a larger population than any Welsh county, save the one in which it is situated. The reason for this concentration of population in South Wales is, of course, the vast industrial development of its rich coalfield.

Industries of South Wales. — Apart from the coal-mining industry, which gives employment to over 200,000 men, there are several important industries which have made their home in the South Wales coalfield.

(1) The *iron* and *steel* industry, dependent at first upon local iron, local coal, and local limestone for fluxing, and now dependent upon imported iron. *Dowlais*, *Ebbw Vale*, *Tredegar*, *Rhymney*, *Aberdare*, *Blaenavon*, *Cardiff*, *Merthyr Tydvil*, and many other centres specialise in iron and steel in many forms.

(2) The *tinplate* industry—the making of steel sheets and coating them with tin, for the manufacture of tins and other receptacles for canned goods, and for use in many of the manufactures—from aircraft to toys. "During 1919 over £54,000,000 worth of meat, fish and milk came into this country from the ends of the earth, a miracle only made possible by the use of tinplate and the protective qualities of this Welsh product."—*The Times*.

The chief tinplate mills (nearly 600) are in Glamorgan, Carmarthen and Monmouthshire. The chief tinplate centres are *Swansea*, *Llanelly*, *Port Talbot* and *Pontypool*.

(3) *Copper-smelting, metal-refining and spelter-making* around *Swansea*, *Llanelly*, *Port Talbot*, and *Clydach-on-Tawe* (Mond Nickel Works).

(4) The manufacture of *coke* and *patent fuel* (from coal-dust).

(5) The extraction of *coal by-products*, *e.g.* benzol, tar, naphthalene, sulphate of ammonia, creosote, toluol and gas.

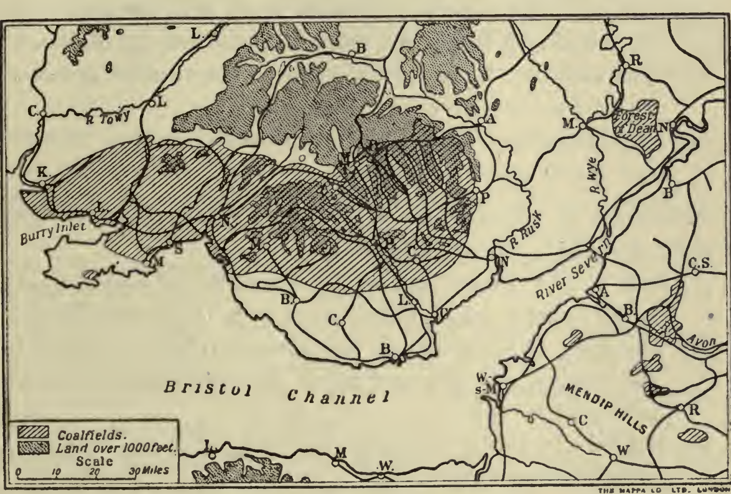

FIG. 65.—THE SOUTH WALES COALFIELD

(6) Manufacture of *silica fire-bricks* (from the millstone grit) for use in steel and other furnaces where great and continuous heat is essential. The chief centres are in the Vale of *Neath*, *Kidwelly*, *Dowlais*, and *Llanelly*.

(7) *Ship-repairing*, an industry in which *Cardiff* leads the world.

(8) *Flour-milling* in the enormous mills at *Cardiff*, *Barry* and *Swansea* and *Newport*, all of which are conveniently situated for the import of grain from Canada, India and the Argentine.

Great South Wales Towns.—CARDIFF, the largest city in the Principality, and the leading coal-exporting centre in the world, has the following advantages:

(1) A splendid harbour and dock-system at a central point on the north busy shore of the Bristol Channel—the ocean gateway of the west.
(2) Up-to-date equipment for handling cargoes, for repairing ships, and for the storage and transportation of goods.
(3) A centre of distribution in direct touch with dense populations in South Wales, the Black Country and the Midlands. Ten millions of people live within a ninety-mile radius of its docks.
(4) Regular steamer service with the world's markets. *Penarth* and *Barry* are its outports.

NEWPORT, in Monmouth, is another great coal-exporting centre, and has similar advantages:

(1) It is at the eastern end of the South Wales coalfield and is the nearest South Wales ocean port to the Midlands.
(2) The river Usk has one of the deepest tidal waterways in the world; and Newport Docks have the largest sea-lock ever constructed.
(3) Behind the port are coal-mines, steel and iron works, etc., as in the case of Cardiff.

SWANSEA, the second city in Wales, and the great steel working, tinplate, and copper and nickel smelting centre, has big oil-refineries. *Port Tennant* and *Port Talbot* are its outports. Swansea is at the mouth of the Tawe, at the head of Swansea Bay which cuts right into the coalfield, making a highway for ships into the heart of the anthracite area.

MERTHYR TYDVIL, the third town in Wales, famous for its gigantic iron works and steel works, is the great inland centre of the South Wales coalfield. Near it are *Dowlais* with its iron works and collieries; *Aberdare*, famous for steam coal; and other centres of industry.

Other towns worthy of note are seaside resorts like *Porthcawl* and *Tenby*; the government dockyard town of *Pembroke*; the cathedral towns of *Llandaff* and *St. David's*; and the Great Western Railway ferry town for Ireland—*Fishguard* (to Rosslare).

Other Welsh Towns.—The Welsh coast and the Welsh hills with their healthful air and fine scenery attract many holiday makers from the big industrial centres of the Midlands and the north of England. The chief are *Rhyl*, *Bettws-y-Coed*, *Llandudno*, and *Bangor* on the north; *Barmouth*, *Aberystwyth* and *Aberayron* on Cardigan Bay; and *Builth Wells*, *Llangammarch*, *Llanwrtyd* and *Llandrindod*—all inland spas with medicinal springs.

Lanidloes, in Montgomery, weaves flannels. Copper and lead mines are close by.

Newtown, in Montgomery, the "Leeds" of Wales, has large woollen industries, potteries, tanneries and breweries.

Welshpool has similar industries. So has *Dolgelly*, in Merioneth, which specialises in flannels and blankets.

Portmadoc exports the Festiniog slates; and *Carnarvon* and *Port Dinorwic* export the Llanberis slates of the great quarries of Dinorwic and Bethesda. *Carnarvon* has metal foundries, tanneries and shipbuilding industries.

Amlwch, in Anglesey, is a copper-mining centre and has chemical works and tobacco factories.

The *Flint* and *Denbigh coalfield* supports the centres of *Wrexham*, *Ruabon* (ironworks), *Llangollen* (woollens), *Flint* (smelting, paper-making, chemicals), *Bagillt* (smelting, chemicals) and *Holywell* (cottons).

Communications.—The general conditions governing communications in the Principality are evident from the orographical map.

Trace on a good map the routes followed by:

(1) L.N.W.R. from Chester to Holyhead (for Kingstown, in Ireland), and its branches.

(2) L.N.W.R. from Shrewsbury to Central and South Wales,

via Craven Arms, Llandrindod, Builth and Llandilo to Swansea and Carmarthen.

(3) G.W.R. *via* Severn Tunnel to the South Wales centres and Fishguard (for Rosslare in Ireland).

(4) M.R. from Worcester, *via* Malvern, Hereford, Hay and Brecon to Swansea and Neath.

The Severn Tunnel, planned by Richardson and opened in 1886, materially shortens the journey between Newport and Bristol. Before the opening of the tunnel the available route *via* Gloucester was over 80 miles; *via* the tunnel it is only 26 miles. The tunnel is 4¼ miles long, and lies 170 feet below high-water mark.

The chief *Welsh canals* are:

(1) The *Glamorgan Canal*, from Cardiff Docks to Pontypool, Aberdare and Merthyr Tydvil.

(2) The Newport, Abergavenny and Brecon Canal.

(3) The Newport, Risca and Crumlin Canal.

(4) The *Neath Canal* from the river mouth to Aberergwm.

(5) The *Montgomery Canal* up the Severn Valley to Newtown.

QUESTIONS AND EXERCISES

1. Great industrial centres arise

(*a*) Where there is coal and iron;
(*b*) Where raw materials are easily accessible;
(*c*) Where there are good transport facilities.

Illustrate this by reference to any centre in South Wales.

2. Draw sketch maps to illustrate the importance of Swansea, Cardiff, Shrewsbury and Merthyr.

3. Explain the following as clearly as you can:

(*a*) The importation of timber, grain and frozen meat in large quantities at Cardiff and Newport.
(*b*) The importation of iron, copper, and lead into South Wales, although all exist in the Principality.

4. Illustrate from the Principality of Wales the chief effects of mountain-land in regard to

(*a*) Railway routes;
(*b*) History.

CHAPTER XXX

THE ENGLISH MIDLANDS AND THE TRENT AND SEVERN VALLEYS

The English Midlands consist mainly of a great plain or low plateau partly enclosed by the Welsh mountains on the west, the oölitic escarpment on the south and east, and the long shoulder of the southern Pennines on the north.

It is a plain or low plateau of red rocks (sandstone and marl) which give considerable character to the region—red earth, red buildings, red rocks in the cuttings; and which have led geographers to call it "The Red Plain." The most important rock is the new red sandstone, through which the coal measures protrude in low humps forming the high ground whence flow the drainage to the Trent, or the Severn, or the Mersey and Dee estuaries. In Charnwood Forest, the Clent Hills and Cannock Chase the Midlands rise above 500 feet.

Economic importance.—The English Midlands contain several important coalfields almost all of which support busy manufactures, and a densely-packed industrial population.

(1) The Derbyshire and Nottingham Coalfield—the southern extension of the Yorkshire coalfield, on the eastern flanks of the Pennines. It supports the lace and hosiery, motor-car, and boot and shoe industries of *Nottingham*, the silk-weaving, the pottery-industry, and the great railway works of *Derby*. It is the chief source of London's coal-supply.

(2) The Leicestershire Coalfield where mining and not manufacturing is the main industry. *Leicester*, some miles from the coalfield, manufactures boots and shoes,

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FIG. 66.—THE MIDLANDS: RELIEF, ROUTES, COALFIELDS AND TOWNS

and weaves woollens and cottons. The chief town on the coalfield is *Ashby-de-la-Zouch*.

(3) The Warwickshire Coalfield, between *Tamworth* and *Nuneaton*, which supports the motor-car and cycle industries of *Coventry*. Farther south is *Rugby* with its electrical engineering works, and its famous public school.

4) The South Staffordshire Coalfield—the "Black Country," where iron-ore occurs with the coal, and where the greatest iron-working and hardware industries in Britain are concentrated at *Birmingham*. Birmingham is not actually on the coalfield, but on its south-eastern edge. In ancient days its iron-smelting was carried on by means of charcoal from the surrounding Forest of Arden (*cf.* Wealden iron industry, p. 241).

Not only iron but many other metals are used in the busy factories of this region. Specialisation has led to the association of certain metal goods with certain towns—*Wolverhampton* for locks and cycles; *Dudley* for nails and chains; *Walsall* and *Wednesbury* for domestic hardware such as stoves, cisterns and bedsteads.

(5) The North Staffordshire Coalfield—the "Potteries," where earthenware and pottery of all descriptions are manufactured. The industry, once dependent on the local clays, is fed by fine Kaolin (china clay) from Cornwall and Devon and other places, and by pipe-clay from Poole. *Burslem*, *Hanley*, *Stoke*, *Newcastle-under-Lyme*, *Longton* and *Tunstall* are the chief centres.

(6) The Mid-Severn Coalfields—Coalbrookdale, where coal was first used in iron-smelting; and the Shropshire coalfield.

In addition to their economic importance as a great manufacturing area, the English Midlands are a valuable farming and cattle-rearing region. The chief industry is dairy-farming on permanent pasture. Barley is largely grown in the Trent valley, and together with the abundant supply of suitable water, and the coal of neighbouring fields, gives rise to the flourishing brewing industry of *Burton-on-Trent.*

The "Vale of Evesham" is famous for its fertility and its fruit-orchards.

Stafford, famous for its boot and shoe factories, lies almost midway between the Potteries and the Black Country. It is on neither coalfield, but enjoys some of the advantages of both. It is an important route centre at the cross-roads between London and the north and Wales and the east of England.

Communications and Routes.—The map of English canals shows how the main canal routes from Humber, Mersey, Thames and Severn intersect and develop in the Midland area. The main focus is the Black Country, which forms the watershed between the Trent and the Severn. Here is a great network of canals into which water has constantly to be pumped on account of their elevation.

The diagram on p. 120 shows the natural gateways of the Midlands—Humber, Mersey, Severn, and Thames estuaries. Of these, by far the most important is the *Mersey Gate* which looks towards the rich markets of the world outside Europe, and particularly towards the Americas with their vast resources of raw material and their increasing demands for manufactures of all kinds.

Towards the Mersey Gate flows the great stream of traffic across the Midlands from London to Liverpool. Across the Midlands run four of the great trunk railways from London to the north and west—the Great Western Railway, Great Central Railway, Midland Railway and London and North-Western Railway. These are linked by several important transverse lines. Trace on the railway map the following routes:

(1) G.N.R. from London, *via* Grantham to York.

(2) M.R. from Derby through Birmingham and Gloucester to Bristol.

(3) L.N.W.R. from London, *via* Rugby and Stafford to Liverpool.
(4) G.C.R. from London, *via* Rugby and Nottingham to Sheffield.
(5) G.W.R. from London to Birmingham.

Notice which parts lie within the English Midlands.

The Trent Valley.—The basin of the Trent occupies a large portion of the Midland region, and the river draws its waters from the Pennines (Peak District) and from the higher regions of the Midland plain, which are usually the coalfields.

The Trent, Dove and Derwent rise in the beautiful Peak District famous for its limestone scenery, its caverns, its medicinal springs, and its well-known health resorts of *Buxton* and *Matlock*. The *Erewash* and the *Leen* flow down from the Derbyshire-Nottingham coalfields. The *Tame* and the *Penk* and the *Anker* drain northwards from the Midland coalfields. The *Sow* flows north past Charnwood Forest from its sources in the oölitic ridge. The *Sow* comes in from the west. [On it is *Stafford*: and near it is *Lichfield*, a cathedral city.] Most of the great Midland manufacturing areas thus lie within the Trent Basin.

The lower valley of the Trent is a rich alluvial plain on which great quantities of potatoes and excellent crops of wheat are grown. *Newark* and *Gainsborough* are the chief market centres; the former is an old castle-town, the latter makes agricultural implements. Near Newark is the great sugar factory of Kelham, recently established to deal with local sugar-beet; near Gainsborough, a river and canal port, the *eagre* or bore of the Trent may be seen (*cf.* Severn bore).

The Severn Basin.—The Severn rises near Plynlimmon—less than twenty miles from Cardigan Bay. Its upper valley is a natural route into Wales from Shrewsbury (p. 271), an old border fortress.

The course of the river may be divided into:

(1) *Upper Valley*—the "Vale of Powis" with the woollen towns of Welshpool and Newtown.

(2) *Plain of Shrewsbury*, famous for its cattle-rearing, dairy farming and agriculture.

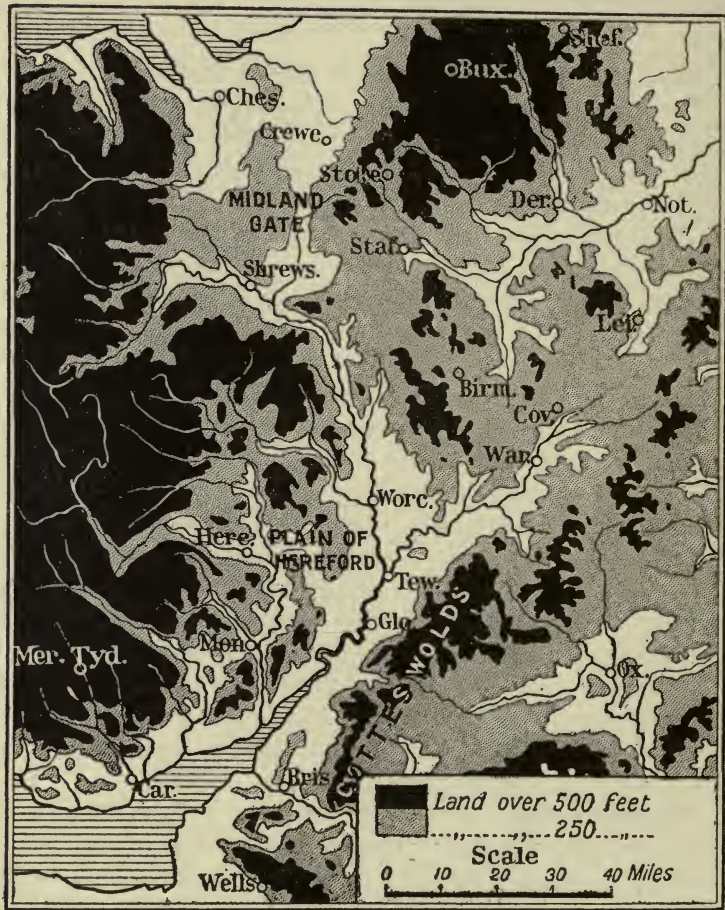

FIG. 67.—THE SEVERN BASIN

(3) *Severn Gorge*, where the river cuts its way between Wenlock Edge and the volcanic peak of the Wrekin

(4) *Plain of Worcester and Gloucester* which is the lower "plain-track" of the river, with wide meanders necessitating a straightening "cut" by canal.

Shrewsbury is a natural fortress, originally built (like Durham) on a rock almost surrounded by a loop of the river. It is an important railway centre and a great focus of roads from the upper Thames region, from Birmingham, from Crewe, and from Wales.

The Severn gorge is cut partly through the small coalfield of Coalbrookdale. *Bridgnorth* weaves carpets. *Stourbridge* with its pottery industries, and *Kidderminster* with its carpet-weaving, lie in the valley of the tributary Stour.

Worcester, a cathedral city manufacturing gloves and porcelain, lies in the middle of the "Plain of Worcester." Not far away are the salt deposits of *Droitwich* which play an important part in glazing Worcester porcelain. The ancient rocks of the Malverns form the western boundary of the Worcester plain; at their foot lies *Malvern*, a famous health-resort with mineral springs.

The Stratford Avon joins the Severn near *Tewkesbury* after flowing through the fertile Vale of Evesham. In its upper valley are *Stratford*, the birthplace of Shakespeare; *Warwick*, "the centre of England," with its famous castle; and *Leamington* with its medicinal springs and fine hotels. *Cheltenham*, at the foot of the Cotswolds, is another inland health-resort with mineral springs.

From the cathedral city of *Gloucester*, a bridge and castle town, northwards to *Stourport* (at confluence of Stour and Severn) the river is partly canalised and controlled by locks. Southwards, the Severn Ship Canal has been cut between Gloucester and *Sharpness*, giving access to the Midland coalfields for the timber, grain and metal which arrive in the Bristol Channel. On its right bank, the Severn receives its Welsh tributaries—*Teme*, *Wye*, *Usk* and *Taff*, whose basins are dealt with in the section on Wales (pp. 269–82). Under the Severn estuary passes the famous Severn Tunnel of the Great Western Railway between Pilning and Portskewett. It reduces the distance from Bristol to Newport by 54 miles (*via* Gloucester 80¼; *via* Tunnel 26¼).

A great project has been brought forward for damming back the Severn at ebb-tide and controlling the outflow to (1) create a great shipping basin above the dam and (2) utilise the water for generating electricity enough to supply the whole of the South Wales coalfield and the Midlands with cheap power and light. The line of the tunnel is roughly the line of the projected dam, which would be wide enough to serve as a viaduct if necessary. Only the heavy capital outlay prevents this barrage scheme becoming an accomplished fact.

Bristol and the Bristol Avon.—The Bristol Avon cuts through the little Bristol coalfield which lies in a huge basin of the carboniferous limestone. It differs from the Welsh and Forest of Dean coalfields in that it is surrounded by rocks younger than coal measures, instead of older.

Bristol was the "Bricg-stow" or bridge-place marking the limit of navigation for ships in mediæval times. The Avon Valley gave easy access to the Thames Basin and London, by way of the Swindon "saddle," or across the high "Vale of Pewsey" and along the Kennet valley. Bristol early traded with Ireland, and for centuries was second only to London as a commercial port. When a New World was added to the old, the Severn and Bristol lay open to the new trading possibilities. Trade in sugar, cocoa and tobacco founded modern Bristol. The neighbouring coalfield supplied fuel and power. To-day Bristol's prosperity depends in the main upon sugar, tobacco, cocoa, leather, oil, timber, and paper pulp imported from the Americas.

Increase of ship-tonnage has led to development of an outport at *Avonmouth* where several important steamship lines berth; and a flourishing fruit-trade has sprung up with the West Indies, Central America, the Canary Islands and the Mediterranean.

Near Bristol is the Avon Gorge in the carboniferous limestone, spanned by the famous Clifton Suspension Bridge.

Bath, the "English Athens," lies in the deep valley of the Avon between Lansdown on the north and Combe and Hampton Downs on the south. It was a Roman health resort; its baths and hot springs made it fashionable then, as they do to some extent to-day.

A century ago there was a flourishing cloth industry at *Devizes*, *Trowbridge*, *Bradford-on-Avon* and other villages; there are remnants of it still. Like the woollen industry of *Stroud*, it depended on the local Cotswold wool, and Cotswold pure running water. The Kennet and Avon Canal links Reading with Bristol, but is almost derelict. The Severn-Thames Canal is totally so.

QUESTIONS AND EXERCISES

1. "The pottery industry of North Staffordshire owed its origin to local clays and to local deposits of gypsum, chert and flints."
   Explain and illustrate this statement.

2. Explain why certain industries have become associated with Burton-on-Trent, Stafford, Worcester and Coventry.

3. Draw a map to show how admirably the English Midlands are supplied with canals.

4. Trace the main railway routes across the Midland Plain. Illustrate by a sketch map.

5. Describe and account for the characteristic scenery of (*a*) the Peak District, and (*b*) the Fenland.

CHAPTER XXXI

THE SOUTHERN PENNINES AND THEIR FLANKS

THE backbone of Northern England is the Pennine Axis—incorrectly called the "Pennine Chain"—which is really a long and fairly high moorland plateau deeply trenched by rivers. Its highest part is towards its western edge, where rise Cross Fell (2900 feet), Muckle Fell, Whernside, Ingleborough and other peaks; and for this reason its west-flowing rivers are shorter and swifter than its east-flowing streams. (Contrast Lune, Ribble and Mersey, with Tyne, Wear, Tees and Yorkshire Ouse.)

The mountain area of the Lake District is linked with the Pennine Axis by the saddle of Shap Fell (about 1000 feet), over which both Midland and London and North-Western railways make their way from the Lancashire Plain to the Eden Valley and Carlisle.

The Pennine Axis.—The Pennine Axis was originally a long domed uplift of the carboniferous limestone, the millstone grit, and the coal measures. The exposed dome has been worn away by weather forces, leaving the limestone exposed in broad surfaces, especially in the Southern Pennines, forming a limestone plateau, flanked by the millstone grit and the coal measures.

The western high peaks and hills are usually masses of millstone grit, still standing upon the limestone.

Like the Mendips, the Pennines are famous for their characteristic "limestone scenery," with deep gorges, craggy cliffs, caverns and subterranean streams, which often reappear at the surface only to plunge down again into "pot-holes" or "sinks." Like the Mendips, too, the Pennines have valuable veins of lead ore (worked in Weardale and in Derbyshire); and large numbers of sheep are reared on their moorlands.

On both flanks of the Pennines lie important industrial areas. Gaps, therefore, in the Pennine Axis are of great importance because they provide natural routes for the flow of traffic between the industrial regions of the west and those of the east. The most important trans-Pennine routes are:

(1) *Tyne Gap*, and valley of the South Tyne, which carries the N.E.R. from Newcastle to Carlisle, by way of Hexham and Haltwhistle

(2) *Wensley Dale* (Ure), through which runs the link between Northallerton on the N.E.R. and Howes junction on the M.R.

(3) *Aire Gap*, through which run (*a*) the M.R. main line from Leeds, *via* Keighley and Skipton to Settle and the north; and (*b*) the Leeds and Liverpool Canal.

(4) *The L. and Y. railway route*, between Liverpool and Hull, *via* the Ribble valley and the upper valley of the Calder.

(5) *The L.N.W.R. route* between Manchester and Huddersfield, *via* the Tame and Colne valleys.

Both of these last routes are more difficult than any of the first three; and expensive tunnelling has been necessary. Like the Aire Gap, too, both of them are used by canals as well as by railways.

The Great Central Railway route from Sheffield to Manchester cuts across and through the South Pennines by the well-known Woodhead Tunnel (3 miles).

Another and more northerly trans-Pennine route is that along the Gretna valley from Barnard Castle and Bowes to Kirkby Stephen.

All of these routes are illustrations of the close relation of routes and relief.

The Southern Pennines and their Flanks. — The southern Pennines form a natural barrier between the plain of Lancashire

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FIG. 68.—ROUTES ACROSS THE PENNINES

and Cheshire and the basin of the Yorkshire Ouse. Politically the region includes Lancashire and Cheshire on the west, and Yorkshire, the largest English county, on the east.

The western plain is milder and wetter than the eastern plain, since it lies on the weather side of the Pennine barrier. This fact has had important results in the distribution of manufactures: the cotton industry grew up in South Lancashire rather than in South Yorkshire, not only because the former region lay nearest the source of raw material, but because the moist climate enabled the cotton to be spun easily without snapping.

Around the flanks of the southern Pennines lie important coalfields to which some reference has already been made—(1) the Yorkshire, Derbyshire and Nottingham; (2) the North Staffordshire; and (3) the South Lancashire. These areas are regions of exceptionally dense population, and support busy manufactures, of which by far the most important are cottons and woollens.

The Cotton Industry is the most important business carried on in the British Isles. It has gathered together most workers per square mile, and it provides the first and most important of our long list of exports. All this is due to special advantages:

(1) The moist climate which enables cotton-spinning to be successfully carried on.
(2) The sea-gate of the Mersey (with Liverpool) and the Manchester Ship Canal (with Manchester) look towards the United States which supply by far the greater proportion of the raw cotton.
(3) The same gateways give facilities for the export of the manufactured goods.
(4) A rich coalfield supplies power, heat and light. Iron, for making machinery, occurs with the coal.
(5) The salt of the neighbouring Cheshire Plain supplies the basis of certain chemicals necessary in many processes of the cotton manufacture.

(6) A skilled population of workers; and the finest cotton-spinning machinery in the world.

(7) A splendid network of railways and canals which provide abundant and cheap transport.

The Woollen Industry, chiefly centred in the West Riding of Yorkshire, owed its beginnings to:

(1) The sheep reared on the Pennine moors.

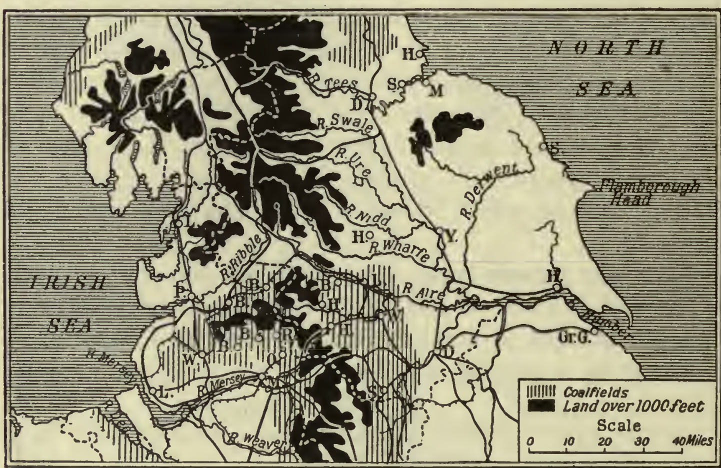

FIG. 69.—THE YORKSHIRE-LANCASHIRE REGION

(2) The abundance of water for washing the wool, and later for cheap power for looms.

(3) The settlement there of exiled Flemish weavers whose beginnings soon grew into a flourishing industry that used the local wool instead of its being exported to Flanders.

The enormous growth of the woollen industry in later years was due to:

(1) The opening up of the Yorkshire coalfield and the

inventions that made steam power derived from coal possible in factories.

(2) The nearness of great ports like Hull and Liverpool through which wool from Australia, New Zealand, the Argentine, Central Europe and South Africa could be imported.

(3) Excellent railway transport which made London a port for wool and an export centre for manufactured woollen goods.

Lancashire.—The plain land of Lancashire narrows northward where the jutting Pennine shoulders of Rossendale and Bowland Forests approach the sea.

Agriculture and general farming are naturally more important in the middle and north away from the busy industrial region of the coalfields. Much of the land is pasture or is used for growing green fodder; oats are by far the most important grain, though wheat and some barley are grown; and potatoes are the chief root-crop.

The chief *cotton towns* are shown in the accompanying sketch map. Certain of them specialise in certain branches of the industry—fine spinning is done chiefly at *Bolton*; while at other centres coarser spinning is the rule. *Widnes* and *St. Helens* specialise in dyes and dyeing; *Oldham* in machinery for spinning and weaving.

MANCHESTER, with *Salford*, the second largest city in the British Isles, the cotton metropolis, *makes* no cotton goods; it collects them for distribution and export. Cotton goods made at Burnley, Blackburn, Accrington, Bolton, Bury, Rochdale, Oldham, and a host of smaller towns and villages in the Pennine valleys, come by rail or canal to Manchester, which buys, warehouses, sells, exports and distributes cotton goods instead of making them. Other textiles—woollens from Yorkshire, silks from the Macclesfield area, alpaca, mohair, woven asbestos from other centres, and jute from Bootle—naturally gravitate towards Manchester, making it the greatest commercial centre for textiles in the world.

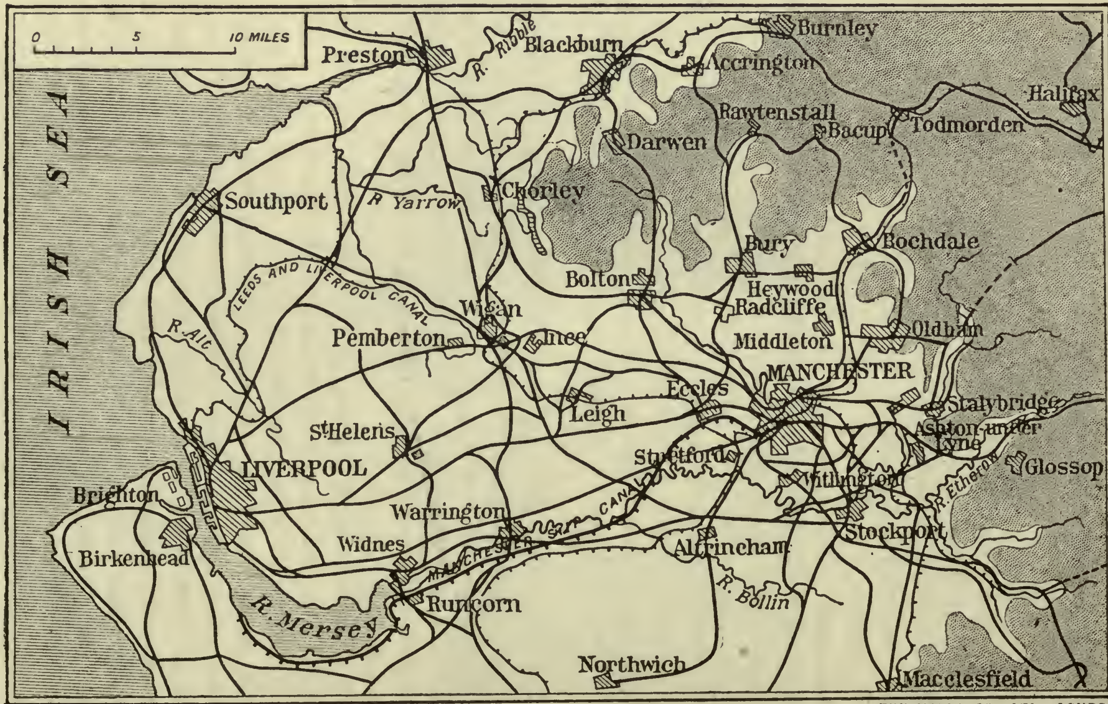

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FIG. 70.—THE MANCHESTER–LIVERPOOL AREA

Manchester stands at a centre whence the Pennines can be crossed along five valleys: (1) To Halifax, (2) to Huddersfield, (3) to Barnsley, (4) to Sheffield, and (5) to Derby and the south, *via* the Derwent valley. Manchester is now virtually a seaport, thanks to the construction of the Manchester Ship Canal, and of enormous docks fully equipped with vast warehouses and intricate networks of railway lines. Not only cotton for the cotton towns, but wool for the West Riding, sugar and grain, tinned goods, glucose, paper, soap, machinery, flour, wines, tobacco, tea, coffee, cocoa, and preserved fruits find ample storage in the 650,000 ton storage accommodation of the Port of Manchester.

Manchester manufactures a great deal of the machinery and plant used in the various industries of South Lancashire. Great blast furnaces have been built on the Ship Canal, and deal not only with local iron ore, but with iron coming from Spain and other countries abroad.

The *chemical industries*, chiefly based on the salt brought from the Cheshire towns along the Weaver navigation, are carried on chiefly at *St. Helens*, *Widnes*, *Runcorn* and *Warrington*, where the production of acids, alkalis, and soap is on a very large scale. *St. Helens* has large glass works. *Port Sunlight* (Cheshire) is famous for soap. The woollen and cotton industries are carried on in the same areas in the Pennine region, *e.g.* at *Burnley*, *Colne* and *Nelson*. *Bury* and *Rochdale* make woollens as well as cottons; *Hyde* makes felts as well as cottons.

Preston has soap works, and oil refineries as well as cotton mills. *Darwen* and *Chorley* manufacture paper. *Warrington* makes cotton, leather, machinery and wire, as well as chemicals and soap. *Lancaster* makes linoleum, oilcloth and furniture; and is also the sheep and cattle market for Northern Lancashire and the Lune valley.

The chief coal-mining centres are *Wigan* and Leigh, Ashton and Oldham. Wigan has important iron industries.

The Furness district of North Lancashire (detached by Morecambe Bay) is famous for its rich hæmatite, which accounts for the rapid growth of the port and iron-smelting centre of *Barrow* and its steel shipbuilding yards. (*Millom* in Cumberland belongs to this district and is engaged in iron-smelting also.)

Liverpool is the great outlet and natural seaport of all these teeming industries, as well as those of the industrial Midlands. It is second only to London in importance; and third in population among British cities. Less than 200 years ago it was a comparatively small port competing with Chester and Preston for the Irish trade. By the ever-increasing trade with America in tobacco and sugar, and later in raw cotton, the port developed apace. To-day the Port of Liverpool extends along Mersey-side for miles, and the whole of England has virtually become its hinterland. It has the best dock, warehouses, and railway accommodation in the world. On the opposite bank of the Mersey is *Birkenhead*, with great shipbuilding and engineering works, connected with Liverpool by a railway under the estuary, and by an elaborate ferry system. Liverpool is the port for numbers of important steamship lines, especially those sailing to Canada and the United States, to South and Central America, and to West Africa. The chief imports in order of importance are:—(1) *Raw materials* for manufacture: cotton, rubber, wool, hemp; (2) *animal products:* live and dead meat, leather, hides, skins and furs, lard, tallow; (3) *grain:* wheat, maize, and rice; (4) *metals:* copper, tin and iron ores; (5) fruit, oilseeds, jute, sugar, tobacco, palm-oil and machinery.

The chief exports are:—(1) *Manufactured goods:* cottons, woollens, machinery, chemicals, linens, carriages, clothing, china, soap, glass, hardware and tools; (2) *metals:* iron, steel, tin and copper; (3) *re-exports:* meat, corn, cotton, wool, rubber, palm-oil, jute, tea and rice.

Liverpool has many industries—notably tobacco manufacturing and shipbuilding. The region in which it lies was long cut off from the rest of south Lancashire by bogs or "mosses" whose name still survives in Moss Side, Carrington Moss, and Mossley—

but railways have long since brought Liverpool in close touch with the rest of Lancashire.

Along the Lancashire coast a chain of small ports and seaside resorts has developed. *Heysham* is the Midland Railway port for Belfast and Dublin. *Preston*, *Fleetwood* and *Glasson* have docks and carry on trade with Ireland as well as fishing. Chief among the pleasure resorts are *Blackpool* and *Southport*; along the Wirral coast of Cheshire are a number of seaside suburbs of Liverpool, notably New Brighton.

The Cheshire Plain.—The Cheshire Plain lies before the Midland Gate between the Pennines and the Welsh Hills. Hence *Crewe*, near its centre, has become a very important route centre and the railway works of the London and North-Western Railway on the main line to the north where branches meet it from all directions.

The plain is one of the richest agricultural and grazing lands in Britain. Dairy-farming is important; Cheshire cheese is world-famous. More potatoes are grown in the peaty soil of Cheshire and South Lancashire than anywhere else in England. Market gardening is profitable, owing to the nearness of great acres of dense population.

The Cheshire Plain is almost surrounded by a "ring of coalfields." Its greatest industry depends upon the salt deposits of the Wirral Valley, worked chiefly at *Northwich*, *Sandbach*, *Middlewich* and *Nantwich*. Borings are sunk into the salt; water is introduced into the bores, creating a subterranean lake of brine which can be pumped up and evaporated to obtain the salt. Some of this brine is carried in big "pipe-lines" to the great chemical works along the Manchester Ship Canal, where it is converted into a number of products, many of which are used in the cotton manufacture of South Lancashire.

Congleton and *Macclesfield* manufacture silk goods. *Chester*, an ancient Roman stronghold, commanding the Northern Gate into Wales, and the route northward from the Midland Plain, was once a considerable port; but the silting up of the Dee has made it inaccessible to any but small craft. It is situated in a bend of the Dee; its castle was built on a sandstone rock above the river. Six main lines of railway radiate from it.

Yorkshire.—Yorkshire, the largest English county, is divided, for administrative purposes, into three "ridings"—North, West and East. The West Riding is largest, busiest, most densely populated, and most important.

Physically the county may be divided into:

(1) The Pennine Moors and Dales (limestone, with millstone grit and coal measures).
(2) The Vales of York and Cleveland (clay and alluvium).
(3) The North York Moors and Cleveland Hills (oölite).
(4) The Vale of Pickering (clay and alluvium).
(5) The Yorkshire Wolds (chalk overlaid with boulder clay).
(6) The Plain of Holderness (silts and gravels).

Yorkshire has on the whole less rain than Lancashire (see rainfall map), and a greater range of temperature; but has rather more sunshine.

The *East Riding* has the highest percentage of arable land; the *West Riding* least. The following table illustrates this and other important facts:

Yorkshire.	Area in Acres.	Percentage of Total Area.			
		Mountain and Moor.	Woodland	Pasture.	Arable.
East Riding . .	748,263	·3	2.5	30.4	59.8
North Riding .	1,357,433	22.4	4.2	39.7	23.8
West Riding . .	1,763,304	13.2	3.8	47.0	19.4

Sheep are the most important stock reared. The wool of Pennine sheep was a dominant factor in the early development of the woollen industry in the West Riding; much sheep-rearing is carried on, too, on the Wolds and Moors of the east.

Wheat, barley, oats, and root crops are grown. Horse-rearing is important, especially in the North and East Ridings. The great market centre of the fertile plain of York is the cathedral city of *York*, a bridge-town and route centre at the head of the Ouse tide-water, occupying a site whose value was recognised by the Romans when they built *Eboracum* there. In the Middle Ages there were many rich abbeys and monasteries in this fertile vale, *e.g.* at *Ripon* and *Selby*.

York is a railway and road centre commanding routes:

(*a*) From the north through the gap commanded by the important market town of *Northallerton*.
(*b*) From the south (1) *via* the Trent valley and Newark and Gainsborough, and (2) *via* the Lincoln gap.
(*c*) From the east and the fertile Vale of Pickering *via Malton*, another market centre.
(*d*) From the west by way of the Pennine Valleys (see p. 294).

Less than a century ago York carried on a prosperous trade with the West Indies; but the increase in tonnage of ships has transferred this to deep tide-water at Hull. The chief industries at York are flour-milling and the making of cocoa and confectionery.

The Yorkshire Coalfield.—The main industries of the Yorkshire coalfield are (1) the weaving of textiles, especially woollens; (2) the steel industry.

Leeds is the chief "clothing town" in the world. It stands at the outlet of the Aire gap at the meeting-place of several Yorkshire dales, and when Yorkshire sent its wool to Flanders, was the chief wool-collecting centre. It has smelters and engineering works also.

Other woollen towns are *Bradford*, *Halifax*, *Huddersfield*, *Wakefield*, *Dewsbury*, *Batley*, *Keighley*, and *Barnsley*. In the west many towns and villages produce cottons as well as woollens. As in the cotton towns, there is much specialisation. *Bradford* is famous for silk, plush, velvet, mohair and woollen cloth; *Halifax* specialises in carpets, baize and light worsteds; *Dewsbury* and *Batley* specialise in shoddy and blankets; and *Saltaire*, the model factory-town of Sir T. Salt, near Leeds, weaves alpaca by processes discovered by its founder.

Harrogate, with its mineral springs, is an inland watering-place (*cf.* Buxton and Matlock).

The chief coal-mining towns are *Wakefield* and *Barnsley,* near which are numerous colliery villages that are rapidly growing into towns. *Pontefract* and *Knottingley* have coal-mines and iron and chemical works. *Castleford* specialises in glass.

The **steel and cutlery industry** is carried on in the south of the West Riding in and around *Sheffield* and *Rotherham.* The industry owes its origin and growth to:

(1) The coal and iron of the Yorkshire coalfield.
(2) The limestone, gannister, dolomite and millstone grit of the Pennines.
(3) The Pennine streams which, before the age of steam, supplied power for the grinding-stones.

Limestone is used as a flux in blast-furnaces; gannister is used for moulds and furnace floors; dolomite for lining the Bessemer converters used in making steel; and the millstone grit for fine grindstones.

Sheffield is the world's greatest cutlery town. It manufactures also railway plant, textile machinery, armour plate, guns, and silver and electro-plate.

Doncaster has large engineering and railway works. It is the great workshop of the Great Northern Railway (*cf.* Derby on the M.R., Crewe on the L.N.W.R., and Swindon on the G.W.R.). It is naturally a great railway centre.

Worksop, in Nottinghamshire, and *Chesterfield*, in Derbyshire, both with important iron and engineering works, belong to this coalfield.

Where the agricultural areas meet the coalfield a number of brewing, flour-milling market centres have sprung, *e.g. Tadcaster*, *Sherburn*, *Whitley Bridge* and *Askern.*

The East Riding.—In the north, at the foot of the Cleveland

Hills, the great iron-smelting centre of *Middlesbrough* has grown along the southern side of the Tees estuary. Its great blast-furnaces depend upon (1) the ore from the Cleveland Hills, (2) the coal of the Durham field, (3) the harbour of Tees-mouth, (4) the local magnesian limestone, and (5) the coke-ovens of the Durham coalfield.

Whitby and *Scarborough* are famous watering-places.

Hull (Kingston-on-Hull) is the great port for the whole of the vast industries of the Yorkshire coalfield, and for the Trent Basin. It stands on a deep estuary facing the Baltic and the great manufacturing countries of Western Europe; it is the chief port of entry for wool, and hence has developed great trade with Australasia as well as with the Continent, and has become the third port of Britain. Nearness to the Dogger has made it an important fish market (*cf.* Grimsby).

Hull exports pottery, lace, beer, hosiery, silks and leather from the Trent basin; iron, steel, cutlery and machinery from the Sheffield-Rotherham area; and woollens and cottons from the West Riding.

Its industries include the manufacture of soap and margarine, flour-milling, and oil-refining. *Goole* stands at the head of the Humber and is far less important; but it carries on a busy trade in small craft.

QUESTIONS AND EXERCISES

1. From a large scale map of Northern England make a tracing to show the main railway routes across the Pennines.

2. Draw two characteristic sections across the Pennine Axis.

3. Summarise and account for the main facts in the following table, which is based upon returns made by the Board of Agriculture and Fisheries.

Riding of Yorkshire.	Total Area in Acres.	Percentage of Total Area.			
		Mountain and Heath.	Woods.	Pasture.	Arable Land.
East . . .	748,263	·3	2.5	30.4	59.8
North . . .	1,357,433	22.4	4.2	39.7	23.8
West . . .	1,763,304	13.2	3.8	47.0	19.4

4. What additional information is given in the following table? What connection has it with that in Question 3? Account for the facts.

Riding of Yorkshire.	Percentage Total Area under				Animals per 1000 Acres.		
	Wheat.	Barley.	Oats.	Roots.	Cattle.	Sheep.	Pigs.
East . .	8.0	10.5	12.1	12.6	13	58	7
North . .	1.4	5.5	5.2	4.8	15	51	5
West . .	2.6	2.9	4.3	4.5	13	56	3

5. Examine carefully the geographical advantages of Liverpool, Manchester, Leeds, Hull and Sheffield. Illustrate by sketch maps.

6. Point out the connection between:

(*a*) The salt industry of Cheshire and the industries of South Lancashire.

(*b*) The Pennine Axis and (1) the woollen industry of the West Riding, and (2) the cutlery industry of Sheffield.

7. What different types of holiday country lie within easy reach of the industrial population of Yorkshire and Lancashire? How can each be reached?

CHAPTER XXXII

NORTH-EASTERN ENGLAND AND THE LAKE DISTRICT

North-Eastern England includes the counties of Northumberland and Durham. It lies between the Pennines and the sea, and stretches from the Tees to the Cheviots.

It includes one of the most important industrial regions of the British Isles, and affords work to over 2,500,000 people. [With it, properly speaking, should be included the iron-working area of Middlesbrough and the Cleveland District (see p. 306).]

More than half the region consists of moorlands and dales, most of which is above 600 feet. Grass-farming is the rule; sheep on the slopes and the moors, cattle in the dales. Population here is necessarily scanty. There are several important quarries where limestone is got for the iron furnaces of the Northumberland-Durham coalfield.

North of the coalfield is a wide strip of rich arable land where barley and potatoes are the chief crops. The Durham dales have fine cattle and large dairy-farms.

Northumberland and Durham Coalfield.—The coalfield supports three-fourths of the population although its area is less than one-fourth of the whole region.

It is the oldest British coalfield, having been worked more or less continuously since about 1239. Coal-mining for export, and iron, glass and chemical industries are the chief occupations. The glass and chemical industries along the Tyne and Tees depend partly on the local deposits of salt.

The "coaly" *Tyne* is one of the busiest rivers in Britain. From Newcastle to the sea there is an almost continuous manufacturing belt where shipbuilding, engineering, chemical manufactures, oil-refineries, glass-works, steel and iron working, and leather and rope-making flourish. *Dunstan*, *Newcastle*, *Gateshead*, *Wallsend*, *Jarrow* and *Shields* are the natural outlets of the coal, and have shipbuilding yards, chemical factories, and steel and iron and engineering works. The *Tynemouth* breakwaters add to the value of the Tyne as a harbour. *Newcastle*, on the site of an old Roman crossing-place on the Tyne and a bridge-

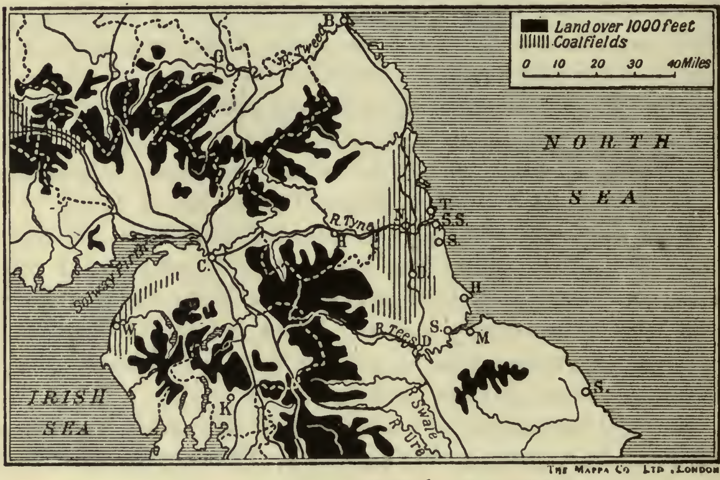

FIG. 71.—NORTH-EASTERN ENGLAND

town where the main north road crosses the river, is the chief centre for the whole of the industrial region.

Blyth, some twelve miles north of Tynemouth, is an important coal port.

Sunderland, at the mouth of the Wear, and the *Hartlepools*, at the mouth of the Tees, have important shipbuilding and engineering works, and carry on a busy trade with Scandinavia and the Baltic.

Consett and *Darlington* have great ironworks—the latter is the engineering centre for the North-Eastern Railway.

Chester-le-Street has electrical works, coke ovens, and chemical factories.

Stockton-on-Tees also has engineering works, and is a market centre for the Tees valley.

Other centres worthy of note in the north-east of England are:

Durham, an ancient cathedral city on a high rocky peninsula in a loop of the Wear, and once the most important centre in the whole of Northumberland and Durham. It is now a market centre and university town. *Bishop Auckland* is a market town. *Berwick-on-Tweed*, the famous border-town, is another. *Saltburn* and *Redcar* on the Durham coast are popular seaside resorts; and *Wooler* is an inland holiday town at the foot of the Cheviots. *Alnwick* has a famous castle in a narrow "corridor" which has been the scene of many conflicts, and which therefore has a number of castles, forts and "peels." *Hexham*, on the Tyne, is a starting-point for rambles over the moors, or visits to the Roman Wall which runs along the Tyne Gap on its north side, a little above the valley bottom.

The Lake District.—Like those of Wales and central Scotland, the mountains of the English Lake District are residual in type; they have been carved out by moving ice and running water from an ancient plateau.

From the central mass, which includes Scafell Pike (3210 feet), Scafell, Great End and Bowfell, there radiate a series of valleys, many of which contain "ribbon" lakes—lakes formed by damming part of a narrow valley. These radiate valleys should be traced on a large-scale map:

(1) *Borrowdale*, leading to Derwentwater and Bassenthwaite Water.
(2) *Ennerdale*, with Ennerdale Water.
(3) The valley containing Buttermere and Crummock Water, and the River Cocker which flows down to Cockermouth.
(4) *Wastdale* with Wastwater.
(5) *Eskdale*.

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FIG. 72.—THE LAKE DISTRICT

(6) *The Duddon Valley.*
(7) *The Rothay Valley* and *Langdale*—Grasmere Lake, Rydal Water and Windermere.
(8) *Yewdale* with Coniston Water.

Helvellyn, with Thirlmere (Manchester's supply of fresh water) on the west and Ulleswater on the east, is another important height. North of it rises the slate hump of *Skiddaw*. Throughout the Lake District there are abundant evidences of former ice work.

The Lake District lies on the western side of England athwart the track of the prevailing wet westerlies, and has a heavy rainfall. *Seathwaite* is the wettest town in England; its average rainfall is 132 inches annually.

Sheep-rearing is the chief industry. There is little agriculture. The Herdwick breed of sheep is peculiar to the district, and is particularly well suited to life on the bleak open fells.

Lead, copper and zinc are mined among the mountains. The graphite deposits which gave *Keswick* its famous pencil industry are more or less exhausted, and graphite has to be imported from Ceylon. Quarrying for slates and building stones is carried on.

The *Cumberland Coalfield* stretches along the north-western coast plain between *Whitehaven* and *Maryport*. *Workington* smelts iron. But the great iron-smelting region is in the Furness District where *Barrow* and *Millom* are the chief centres.

Kendal, junction for Windermere, manufactures boots. *Grasmere* is famous as the home of Wordsworth and Ruskin. *Silloth* is a small port in the Solway Firth. From the junction of *Penrith* the Furness railway branches westward to the Cumberland coalfield and the coast.

But by far the most important town is the great railway centre of *Carlisle*, from which radiate:

(1) The L.N.W.R. and the M.R. to London.
(2) The Cambrian Railway to the Cumberland coalfield.
(3) The N.E.R. to Newcastle, *via* Tyne Gap.

(4) The North British "Waverley" route to Edinburgh.
(5) The Caledonian to Glasgow and Edinburgh.
(6) The Glasgow and South-Western to Glasgow.

Carlisle, at the focus of so many important routes, is naturally a market town. It has a fine cathedral. Formerly a port, it has been practically closed by the silting up of the Solway. Like Berwick-on-Tweed, it has played an important part in border warfare and was a natural fortress.

The Isle of Man.—Although the island lies about midway between England and Ireland, the Isle of Man belongs to Great Britain geographically. Its rocks are similar to those of the Lake District, Wales, and the Southern Uplands of Scotland. *Snaefell* (2034 feet) is the highest peak. The chief grain crop is oats. Sheep are reared, and woollens are manufactured. Lead, copper and zinc are mined.

The island is a famous holiday resort. *Douglas*, *Ramsey*, *Castletown* and Peel are the chief towns.

The Isle of Man has its own parliament—the House of Keys.

QUESTIONS AND EXERCISES

1. Illustrate the importance of Carlisle as a centre of routes.

2. Trace the main lines of communication between Northern England into the Scottish Rift Valley, and point out how far each follows a natural route.

3. Explain:
(*a*) Why sheep-rearing is the chief industry of the Lake District.
(*b*) Why so many of the lakes are "ribbon lakes."
(*c*) Why the Lake District is so wet.

4. Name four tourist centres in the Lake District and state (*a*) how they can be reached from London or Leeds, and (*b*) what interesting scenery can be easily approached from each.

III.—SCOTLAND

CHAPTER XXXIII

SCOTLAND

SCOTLAND covers more than a third of the total area of Great Britain, but contains less than one-eighth of Great Britain's population, for reasons that will be apparent later.

Notice the important fact that Scotland lies in a more westerly longitude than Britain. More than half England and Wales lies east of longitude 2° W.; while practically the whole of Scotland lies west of that line. As a result (1) Scotland is farther away from, and less influenced by, the continent of Europe than England is; and (2) Scotland's nearness to north-east Ireland has had important historical and economic effects.

Physical Divisions.—Scotland falls into three main divisions, more or less determined by the geological structure of the country:

(1) *The Highlands*, with the western island fringes, embracing over two-thirds of the country, and formed chiefly of hard old rocks of metamorphic type.

(2) *The Central Lowlands*, known also as the "Midland Valley" and the "Scottish Rift Valley," between two great fault-lines:

  (*a*) On the north between Stonehaven to the mouth of the Clyde.

  (*b*) On the south between Dunbar and Girvan.

(3) *The Southern Uplands*, also a much worn plateau dissected by streams, but formed of rocks different from those of the highlands.

FIG. 73.—SCOTLAND: PHYSICAL DIVISIONS

Rivers.—Scotland is well supplied with *rivers*—the result of its abundant rainfall, and its hard old rocks that prevent much water sinking into the ground. But most of them are too swift or too shallow for navigation. The Clyde, which has been artificially deepened ; the Forth, which is navigable to Stirling ; and the Tay, navigable to Perth, are notable exceptions.

Their valleys are, however, in many cases important (*a*) as natural routes, (*b*) as regions of cultivation and settlement. Many highland rivers have long "ribbon lakes" in their upper courses, *e.g.* Lochs Rannoch, Tay, and Earn in the Tay system. Very little use has hitherto been made of the enormous free "power" of the Scottish rivers, and in many a glen tens of thousands of horse-power are running to waste every day. The Falls of Foyers in Inverness (near Lake Ness) have, however, been harnessed to provide power for the great aluminium works there; and similar aluminium works have been set up at Kinlochleven at the head of Loch Leven. Good examples of the importance of river valleys in providing natural routes for railways are seen in:

(1) *The routes across the Southern Uplands.*

- (*a*) "Waverley" (North British) route up Liddesdale, across the middle Tweed basin, and up Gala Water Valley and over to Dalkeith and Edinburgh.
- (*b*) The Caledonian route from Carlisle, *via* Annandale to Beattock, and over the pass to the upper Clyde Valley.
- (*c*) The Glasgow and South-western route, *via* Dumfries and Nithsdale and the Ayrshire lowlands.

(2) *The Highland Railway from Perth to Inverness.* Trace the route carefully up the Tay Valley to Ballinsluig at the confluence of Tummel and Tay; up the Tummel Valley past Pitlochry, and thence, *via* the valley of the Garry (Killiecrankie Pass), almost to its head; over the Pass of Drumochter (1504 feet) to the Truim Valley, and down it to the Spey Valley

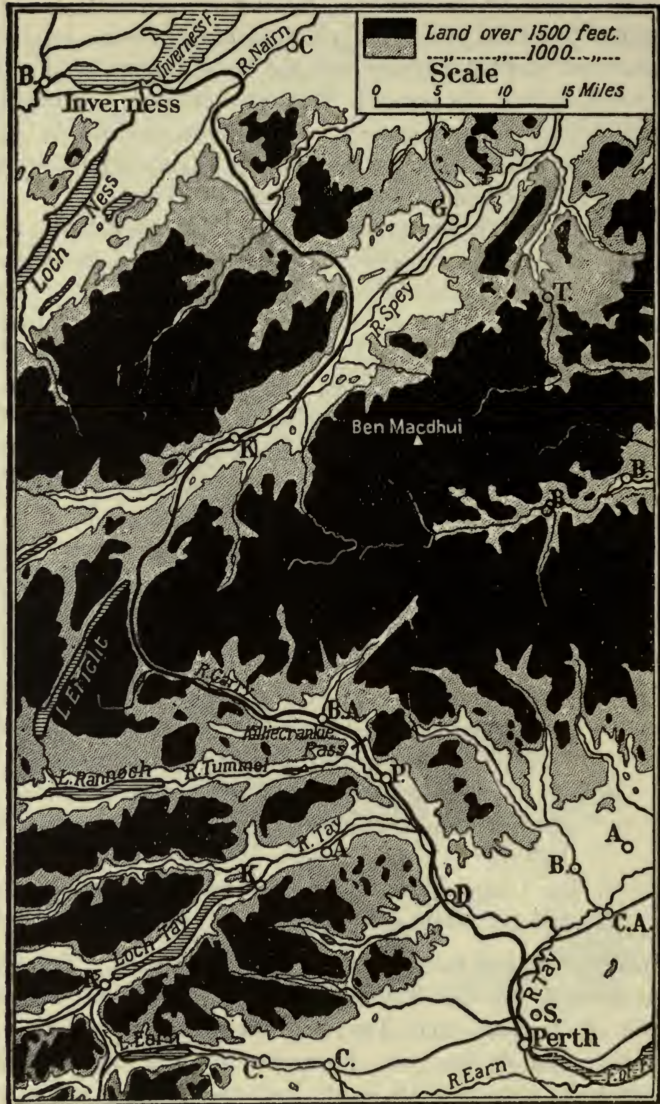


FIG. 74.—ROUTE OF HIGHLAND RAILWAY FROM PERTH TO INVERNESS

at Kingussie; down Strath Spey to Aviemore, whence the line crosses the Slochd Mhuic Pass, then the Findhorn Valley, over which it is carried by a viaduct, and finally sweeps down by way of Strath Nairn to the Moor of Culloden and Inverness.

Climate.—In spite of the fact that Scotland is in the same latitude as Labrador, the country enjoys ice-free harbours, mild winters at sea-level, and comparatively small range of temperature. The reasons for these advantages have been discussed on pp. 24–39.

Note particularly that:

(1) Scotland is wetter than England, and has a higher absolute maximum of rainfall and a higher average rainfall because:

  (*a*) Its extensive highlands face a broad open warm ocean over which blow the prevailing winds.

  (*b*) The country is narrower from east to west, and is not sheltered as England is by Ireland.

(2) Scotland on the whole is more generally insular in its climate than England which in the south-east approximates to a continental type.

(3) As in England the western side is very much wetter than the eastern. Even in the Midland Valley the western counties are less important for the growth of grain and more important for stock-rearing than the drier eastern counties.

(4) North-western Scotland is as warm in January as the Isle of Wight. Edinburgh has roughly the same mean January temperature as London, in spite of its higher latitude.

Vegetation, Agriculture and Stock-rearing.—Forests are comparatively scanty owing to (*a*) the comparatively high elevation of much of the land, and (*b*) to extensive deforestation in past years.

Large portions of the upland areas are moorland. *Moors* covered with heather and blaeberry are the grouse moors and "deer forests," which give good shooting to those who can afford it; moors covered largely with grass are valuable pasture-land for cattle and sheep.

About one quarter of Scotland is under crops and grass, and less than 20 per cent. is good arable land. Nearly half Scotland consists of moor and mountain, and only about 5 per cent. is forested.

Wheat is grown chiefly in Fife, Haddington, Linlithgow, Midlothian and Forfar—all in the drier and sunnier east. *Barley* is cultivated much more widely. *Oats* grow wherever the soil permits, and the average yield is nearly six times that of barley and over sixteen times that of wheat. The most important counties for oats are Aberdeen, Banff, Berwick, Haddington, Kincardine, Kinross, Linlithgow and Wigtown.

Potatoes are an important crop, especially in Aberdeen, Banff, Berwick, Fife, Haddington, Kincardine, Kinross, Linlithgow and Midlothian.

Scottish agriculture appears to be much more profitable economically and much more efficient than English agriculture, if we are to judge by the higher yield per acre. *Flax*, formerly grown widely in Scotland for domestic and factory industries, is now imported from abroad in large quantities.

The chief *cattle-rearing* counties are Wigtown, Stirling, Renfrew, Lanark, Kirkcudbright and Dumfries—all in the moister west, where good permanent pasture exists. *Sheep* are most widely reared in the southern uplands—in Dumfries, Kirkcudbright, Berwick, Peebles, Selkirk and Roxburgh. It is a noteworthy fact, however, that the Shetlands, in spite of local disadvantages, rear nearly as many sheep per hundred acres as Dumfries, and more per hundred acres than Selkirk.

Fruit-farming is important, especially in the fertile Strathmore and Carse of Gowrie, and in Lanark. The mildness of the Ayrshire coastlands permits of the raising of early potatoes and spring flowers (*cf.* Cornwall and the Scillies).

Fishing is carried on at the many ports and small villages along the much-indented coast-line. The heavy catches are made by steam trawlers and motor-boats from the larger ports. Aberdeen is the great fishing centre.

Salmon are caught in many of the rivers, especially in the Tweed, and in the sea-lochs.

The Scottish Coalfields.—Scotland's chief mineral wealth lies

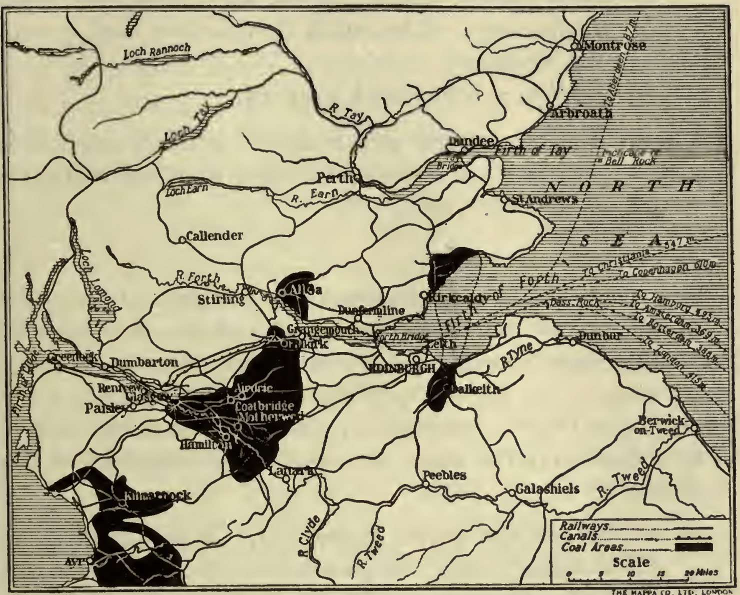


FIG. 75.—RIVERS, CANALS AND COALFIELDS IN THE SCOTTISH RIFT VALLEY

in her coalfields, all of which are in the great Midland Valley where the chief iron deposits also occur.

The coal occurs in geological basins, on whose edges the calciferous sandstone (sand held together by limestone), which in Scotland takes the place of the pure limestone of England, comes to the surface. The best coal-seams are found in the lower carboniferous rocks instead of in the coal measures as in England.

The chief Scottish coalfields and their dependent industries may be summarised as follows:

I. Ayrshire Coalfield.

(*a*) *Shipbuilding:* Ardrossan, Ayr and Troon.
(*b*) *Copper-smelting:* Irvine.
(*c*) *Iron-smelting:* Dalmellington, Kilwinning, Cumnock.
(*d*) *Engineering:* Kilmarnock (locomotives and pumping machines).
(*e*) *Woollens:* Kilmarnock (carpets).

A great deal of coal and iron from the Ayrshire coalfield is exported to Belfast and north-east Ireland from the coal-ports of Ayr, Ardrossan and Troon.

II. Lanark Coalfield.

This is by far the most important in Scotland. It supports Scotland's busiest industrial population, and within its area all Scotland's manufacturing industries are represented. In this latter respect the Lanark coalfield differs radically from the typical large English coalfields, in which there is a high degree of specialisation in industry. Among the chief industries of this coalfield are:

(*a*) *Shipbuilding* and *marine engineering:* On both sides of the Clyde estuary from Glasgow to the sea. On the north side are Dumbarton, Bowling, Kilpatrick, Dalmuir, Clydebank and Partick; on the south side, Greenock, Port Glasgow, Renfrew and Govan.

(*b*) *Cotton-spinning and weaving:* At Paisley, Lanark, Hamilton and Renfrew.

(*c*) *Iron-smelting:* At Motherwell, Wishaw, Newmains and Shotts, in the valley of South Calder Water; and at Coatbridge on North Calder Water. Near the Forth, too, are the famous Carron ironworks. The famous "black band ironstone" which formerly supplied the Scottish iron industry is now nearly exhausted, and iron ore has to be imported from Spain.

Other industries are *coal-mining* (especially at Hamilton), *silk* and *woollen weaving*, *sugar-refining* (Greenock), *pottery* and *glass-making*, *chemical industry*, and *metal industries* (Singer sewing machines).

III.—Firth of Forth Coalfields.

The coalfields of the Firth of Forth are the *Clackmannan*, the Fife, and the Midlothian (connected by coal measures beneath the Firth. Coal is being raised on Preston Island).

The *coal-ports* of these fields are Alloa in Clackmannan, Grangemouth in Stirling, Bo'ness (Borrowstoness) in Linlithgow, and Methil in Fife. These coalfields support the *milling*, *brewing*, *distilling* and *paper-making* of Edinburgh; the *linen* and *jute* industry of Dunfermline and Dundee; the *linoleum* and *oilcloth* industry of Kirkcaldy; and the *woollen* industries of Stirling, Alloa, Tillicoultry and Alva.

Other Minerals.—*Iron*, now inadequate for local demand, occurs chiefly on the Lanark and Ayr coalfields; but less than 5 per cent. of the total iron-ore raised in the British Isles is Scottish. *Oil-shale*, mined in the calciferous sandstones of Linlithgow and Midlothian, yields oil distillation, and much petroleum and wax are obtained. Every ton of shale yields about twenty gallons of oil, and nearly fifty pounds of ammonium sulphate, a valuable fertiliser.

Lead is mined in the Lead Hills of Lanark, especially at Leadhills and Wanlockhead.

Building-stones are quarried. *Granite* is obtained near Peterhead and Aberdeen; *slate* in the highlands; *sandstone* at Craigleith and Tranent.

Aluminium is obtained at the Falls of Foyers in Inverness and at Kinlochleven, where abundant cheap power is available.

QUESTIONS AND EXERCISES

1. Show on a sketch map the position and approximate extent of the Scottish coalfields. Indicate the main industries associated with each.

2. Illustrate by reference to a Scottish railway the importance of river valleys as natural routes.

3. Draw a section to scale across Scotland from Rum to Stonehaven.

4. Compare and contrast the distribution of population in Scotland with that in England. Account fully for similarities and differences.

5. On an outline map of Great Britain show the three great main routes from London to the Midland Valley of Scotland. Mark great towns.

6. Explain why Scotland's climate differs from that of Labrador, although both countries are in the same latitudes.

CHAPTER XXXIV

THE SCOTTISH "LOWLANDS"

Between the "Highland boundary fault" (Stonehaven to Helensburgh) in the north, and the great fault-line from Dunbar to Girvan, lies the richest and most densely-populated area of Scotland. It is known as the "Lowlands," or the "Central Lowlands," or the "Scottish Rift Valley," or the "Midland Valley of Scotland."

This region is most important because:

(1) It contains the great coalfields of Scotland, and consequently the great industrial areas with their dense population.

(2) It contains the richest soil and the most extensive area of arable land and permanent pasture in the country.

(3) It has two great estuaries; one facing eastward toward the busiest countries of the European continent, and the other facing westward toward the rich Americas with their inexhaustible supplies of food and raw materials, and their busy markets.

Structure.—Although called the "Lowlands," this region is by no means a flat unbroken plain. Parallel with the great fault-lines run two more or less distinct lines of hills (chiefly of volcanic rocks)—in the *north* the Kilpatrick Hills, Campsie Fells, Fintry Hills, Ochil Hills and the Sidlaw Hills; and in the *south* the Haughshaw Hills, the Pentland Hills and the Lammermoor Hills (the hills of Arran belong to the same belt). The highest point in the northern line of hills is *Bencleuch* (2363 feet), in the Ochils; in the southern, *Tinto* (2335 feet), south of Lanark.

In the gaps in these hill-chains stand important route-centres like *Perth* (Tay Gap, between Sidlaws and Ochils), *Stirling* (Forth Gap, between Ochils and Fintry Hills).

Between the northern hill-chain and the highland boundary fault runs *Strathmore*, the great "strath" or valley whose fertility has made Perth a big market town. Mixed farming

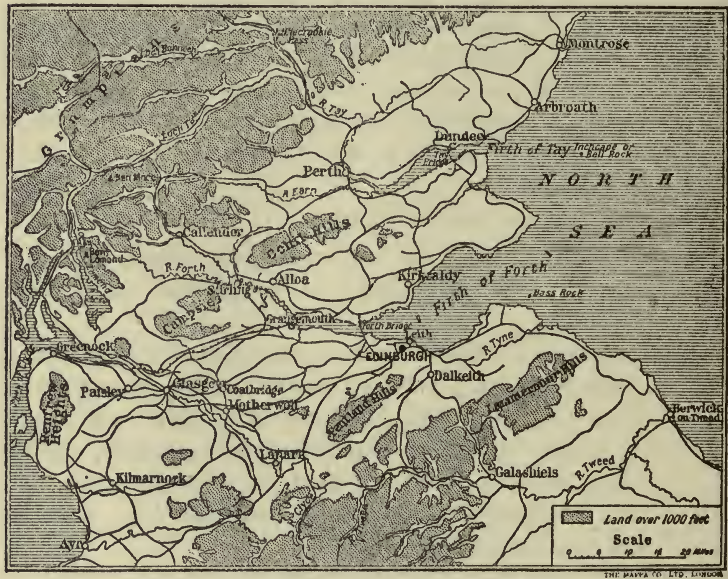


FIG. 76.—SCOTTISH RIFT VALLEY, SHOWING RAILWAYS AND CANALS

prevails. Potatoes and barley (for local distilleries) are especially important.

Between the Firth of Tay and the sheltering Sidlaws lies the fertile Carse of Gowrie, which supplies wheat and fruit. *Dundee* utilises much of this fruit in the manufacture of jam; but the city is more famous for its marmalade, which depends upon (1) imported fruit from Spain, (2) cheap beet sugar from Middle Europe, and (3) accessibility of Fife coal.

The *Forth and Clyde Canal* connects the two great estuaries, running from Glasgow, *via* Kirkintilloch, and Falkirk to Grangemouth. The Union Canal links it with Edinburgh. At present this canal is too narrow for large vessels, and a project has long been mooted for its conversion into a ship-canal like that which has made Manchester a seaport. When this is done, it will have the effect of making Glasgow an east-coast port, and Edinburgh a west-coast port.

Great Industries.—These have been summarised in connection with the coalfields which support them (p. 320). The reasons for their development and persistence are important.

THE STEEL, ENGINEERING AND SHIPBUILDING industry on the Clyde owes its development to:

(1) Rich coalfields, which formerly contained some of the most valuable iron deposits in the country.
(2) Limestone (for fluxing) occurs in the coalfields.
(3) The artificial deepening of the Clyde, which has made the estuary a great port, facing the Atlantic and convenient for the ocean routes of the world.
(4) The need for marine engines and the use of steel for shipbuilding which enabled Glasgow to gain and maintain its lead in ship-construction and marine engineering.

THE COTTON INDUSTRY of the same region has the following advantages:

(1) Moist climate suitable for cotton-spinning.
(2) Nearness of coal.
(3) Machinery manufactured locally.
(4) Convenience of the Clyde estuary for importation of American cotton.
(5) Splendid facilities for export of cotton goods.
(6) Development of chemical industries at Glasgow and Larkhall ensures supply of dyes, bleaching materials, etc.

[The *sugar-refining* and *tobacco-manufacturing* depend mainly upon trade with the Americas in raw sugar and tobacco.]

THE LINEN INDUSTRY had its origin in the domestic industry dependent upon the flax raised in Forfar, Fife and neighbouring counties. The many streams gave water for "retting" and later for cheap power.

After the Industrial Revolution, the accessibility of coal, and the convenience of Dundee and other east-coast ports for the importation of flax from Russia, developed and established the industry.

Dunfermline, *Alloa* and *Kirkcaldy* make fine linen; *Montrose*, *Arbroath* and *Forfar* make coarser fabrics.

In the linen-manufacturing areas three important and connected industries are now flourishing:

(1) *Jute* fabrics, made from Indian jute, especially at Dundee.
(2) *Oilcloth*, made from jute or flax, and covered with composition in which linseed oil is an important ingredient. Kirkcaldy is the chief centre.
(3) *Linoleum*, which also involves the use of linseed oil, but uses cork from Spain, with sometimes a backing of jute. Kirkcaldy is the chief centre.

The Paper Industry, centred chiefly at Edinburgh and carried on in numerous villages and towns around the city, depends on:

(1) Abundance of pure water, from the streams of the southern uplands.
(2) Abundance of coal from the Lothian coalfield.
(3) Accessibility of paper pulp from Scandinavia, Finland and Russia, *via Leith*, the port of Edinburgh.

Two Great Scottish Cities.—Glasgow, the second city in the British Isles, and the fourth British port, had a population of only 13,000 in 1707. By 1801 it had risen to nearly 84,000, and to-day (with its suburbs) its population approaches 1,500,000. This vast and rapid growth has been due to:

(1) Glasgow's position facing the Americas, which enabled the port to take a leading part in the trade with the New World, especially in tobacco and sugar.

(2) The rich coal and iron fields behind the port, which fostered (*a*) manufactures of cotton, sugar, tobacco, and steel; (*b*) shipbuilding and engineering.

(3) The deepening of the Clyde by Watt, Telford and Galthorne. Two hundred years ago the Clyde could be forded

FIG. 77.—THE CLYDE BASIN

below Glasgow. Now there is a deep channel which admits ocean-going steamships to the great docks of the city.

The old Glasgow owed its origin to:

(1) Its site at a ford that commanded the western route, at the junction of highlands and lowlands.

(2) Its bridge near tide-limit, upon which routes converged lowlands and highlands.

Glasgow's water supply comes from Loch Katrine in two aqueducts thirty-four miles long.

EDINBURGH owes its beginnings to its castle rock, an old volcanic plug that afforded a splendid site for a fortress. (Dumbarton and Stirling castles occupy similar rocks.)

(1) Its castle commanded the narrowest part of the coastal plain between the Pentlands and the sea.

(2) Its port was on a deep and sheltered estuary, and near the town.

(3) The city grew up at the meeting-place of sea, lowland and upland.

(4) In later times the discovery of coal and iron, the development of the oil-shale deposits, the abundance of pure water for brewing, distilling and paper-making ensured to Edinburgh a new prosperity.

(5) The construction of the Forth Bridge, and of the naval base at Rosyth, have added importance.

Other Lowland Towns.—*Perth*, at the head of the Tay estuary and below the convergence of many valleys, is one of the "keys" to the highlands, and naturally a great route-town and market centre. Its dye-works depend on its abundant supplies of pure water.

Stirling, in the Forth Gap, was another strategic key to the highlands. It is still a great market centre, and an important route-town, but the building of the Forth Bridge has diverted the main route from the south to a line much farther east.

The *chief holiday resorts* for the busy industrial area of the lowlands are Dunoon, Rothesay, Lamlash, and Ardrishaig.

QUESTIONS AND EXERCISES

1. Explain the origin and structure of the great Midland Valley of Scotland.

2. Set forth the geographical importance of Glasgow, Edinburgh, Perth, Aberdeen and Stornoway. Illustrate your answer by sketch maps.

3. Explain the existence of certain typical industries at (*a*) Dundee, (*b*) Stornoway, (*c*) Galashiels, (*d*) Edinburgh, and (*e*) Port Glasgow.

4. Which are the three chief Scottish railways? Which areas do they serve, and what are the chief route-centres of each?

CHAPTER XXXV

THE SOUTHERN UPLANDS

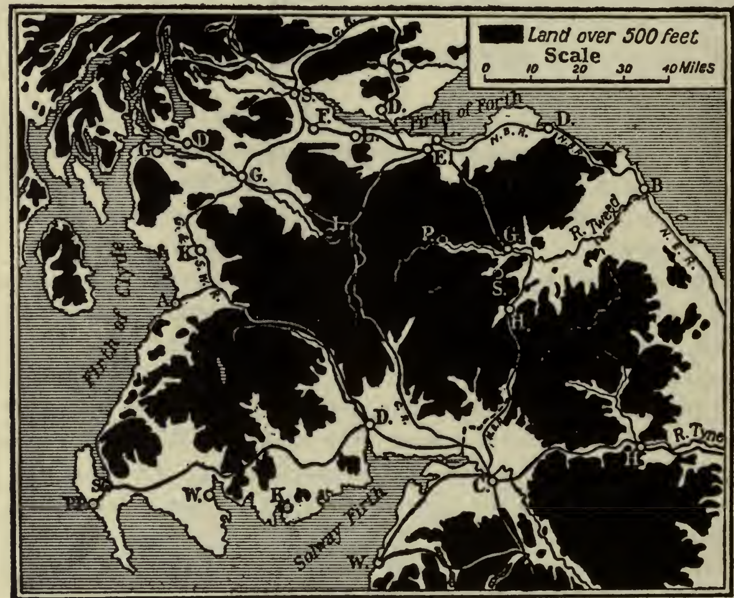
The Southern Uplands are an old plateau much dissected by streams, forming a natural barrier between the Scottish lowlands and northern England. Its highest points are Broad Law (2754 feet), Mount Merrick (2764 feet), and Hart Fell (2651 feet).

The region is scantily populated in comparison with the industrial Midland Valley, and it has few natural resources. Its upland character renders sheep-farming more important than agriculture. The Merse of Berwick and the many deep and sheltered valleys are very fertile, which is one of the reasons for the monastic establishments at places like *Melrose*, *Jedburgh* and *Kelso* in mediæval towns. The county of Wigtown is the greatest cattle-rearing county in proportion to its area, and therefore is famous for pigs which fatten on the waste of the dairy industry.

The Southern Uplands, with the Cheviots, form the "Border Country" of Anglo-Scottish warfare before the Union. The whole region is remarkable for the very large number of castles and "peels" (towers), which occupy points of vantage in this much-contested barrier-belt. The easiest route into Scotland in the old days, as now, was by way of the eastern coast-plain. In the west, Shap Fell and Solway Moss offered serious obstacles.

Routes from England into Scotland across the Southern Uplands follow the natural ways along the river valleys, as has already been shown on p. 315. Note the importance of the London and North-Western Railway and Great South-Western Railway connections from Carlisle along the southern coastal plain with *Stranraer*, the Scottish ferry-town for *Larne*, in Ireland—the shortest sea-route (thirty-six miles) between Great Britain and Ireland.

Industries and Towns.—The importance of the upland pastures for sheep-rearing invites comparisons with those of Wales.



THE MAPPA CO., LTD., LONDON.

FIG. 78.—ROUTES ACROSS THE SOUTHERN UPLANDS

The counties of the Southern Uplands are Scotland's chief sheep-rearing regions, and the wool thus available was the main cause of the development of woollen manufactures in the Tweed Valley.

The *woollen industry* of the middle Tweed is mainly concentrated at *Hawick*, *Selkirk*, *Galashiels* and *Melrose*. It arose because of:

(1) Abundance of local wool from local flocks.

(2) Abundance of clear running water for wool-washing, and later for power.

It has persisted because of:

(1) The accessibility of coal and machinery from the Midland Valley.

(2) Facilities for importation of wool from Australasia and the Argentine, *via* Leith.

(3) The presence of a highly-skilled population.

Most of the other population centres are market towns like *Dumfries*, *Newton Stewart*, *Kirkcudbright* and *Wigtown*.

Greenlaw, in Berwick, is a sheep-market; *Duns* also is a market town. *Leadhills* is famous for its lead mines. *Sanquhar* belongs to the industrial area of the Ayrshire coalfield. *Prestonpans* yields salt for curing fish and for the chemical works of the Midland Valley. *Dunbar* is a fishing centre.

The Scottish Highlands

The whole of the region north of the Midland Valley is known as "the Highlands." It has an average elevation of over 1500 feet which, together with the character of the rocks, makes it unfit for the support of a large population. It has practically no coal, communications are difficult, and the climate, owing to the high average elevation, is raw and unfavourable. Hence, people, industries and towns are few. Yet this region comprises more than two-thirds of the total area of Scotland. There are some areas, however, which are distinct from the rest, in that they have fertile soil, and so support a denser population. These are regions in which the Old Red Sandstone occurs. They lie along the north-eastern shorelands, especially in the plains of Caithness, and round the Moray and Dornoch Firths. Reference to the population map and to the geological map of Scotland will illustrate the importance of these fertile Old Red Sandstone regions.

Relief, Drainage and Coastline.—Like the mountains of Wales and the English Lake District, those of the Scottish highlands have been carved out by water and weather from an ancient plateau. They are what are known as residual mountains.

The narrow rift-valley of Glen More divides the region into (1) Northern Highlands; (2) Central or Grampian Highlands. The lochs and rivers of Glen More have been linked up to form the *Caledonian Canal*, which is of little importance as a trade route and is used principally for tourist traffic. It contains many locks, and does not admit large ocean-going steamers.

On the west, the Highland region has undergone extensive subsidence which has allowed the sea to penetrate far up its ice-worn, water-worn valleys and turn them into the sea-lochs which form so characteristic a feature of western Scotland. Outlying heights appear now as rocky islands separated from the mainland, and from one another by deep-sunken channels.

The ice of prehistoric glaciers has left its mark everywhere—in the scooping out of rock-basins, in the damming of valleys to form long narrow lakes, in the scratching and polishing of rock-surfaces, and in leaving behind accumulations of morainic material, as in the *Kames* of the lowlands, and in the thick layers of boulder clay.

The North-western Highlands with their deep narrow glens, rugged sandstone peaks, swift torrents, and inhospitable soil, are of little or no economic importance, and towns and villages are chiefly on the coast where a living can be won from the sea to eke out the scanty subsistence of the crofter. Large areas are covered with grouse-moor and deer-forest; the only fertile soil is in the narrow valley-bottoms.

The Central Highlands, also of hard crystalline rock, contain the highest peaks in Great Britain—Ben Nevis (4406 feet), Cairngorm, Ben Macdhui, and others being over 4000 feet. Several large rivers flow from the central mountains—the *Spey* and *Findhorn* to the north, the *Dee* and the *Don* to the east, and the *Tay* to the south-east. Of these the most remarkable is the Tay, which is the largest river in Scotland, though by no means the most important. In the south-western highlands lies the region beloved of the tourist. It includes the beauties of the Trossachs, of Loch Katrine and Loch Lomond. Here the "tourist industry" assumes considerable proportions and importance,

FIG. 79.—THE SCOTTISH HIGHLANDS

and is fed by coach, car and rail from the four "keys" to the highlands—Glasgow, Edinburgh, Stirling and Perth.

The Scottish Islands consist of (1) the Outer Hebrides (Lewis and Harris, North Uist, etc.); (2) the Inner Hebrides (Skye, Mull, Jura, Islay, etc.); and (3) the Orkneys and Shetlands in the north.

Skye and Mull are chiefly solidified lava. Off Mull is the island of *Staffa*, famous for its remarkable Fingal's Cave, built of pillars of columnar basalt like those of the Giant's Causeway in Antrim, North Ireland.

Occupations and Towns.—West-coast highlanders are fishers, or shepherds, or both. East-coast highlanders are fishers, or shepherds, or farmers, because the rich soil over the Old Red Sandstone encourages agriculture and general farming.

The highland crofters cultivate barley and oats, potatoes and other root crops, and rear hardy ponies and long-horned mountain cattle.

In Perth, Aberdeen and Inverness the moors are grassy enough to permit of extensive sheep-rearing; and cattle and horses are reared in the valleys and on the coastal plains, where Irish cattle are specially fattened for the English markets. Fishing and fish-curing are important at *Aberdeen*, *Peterhead*, *Findon*, *Buckie*, *Dornoch*, *Wick* and *Fraserburgh*.

Stornoway, the capital and chief fishing port of the Outer Hebrides, is the centre of the fish-canning industries opened up by Lord Leverhulme in Lewis.

Granite is quarried near and exported from Peterhead and Aberdeen. Aluminium is produced at the Falls of Foyers and at Kinlochleven.

The weaving of tweeds is carried on as a domestic industry in the north-western highlands, in Lewis, and in the Orkneys and Shetlands; and the dyes used are local vegetable dyes.

Routes and Communications.—The Highland Railway from Perth (see p. 315) goes *via Inverness* and *Dingwall* to the north at *Thurso*. A branch line runs across Ross and Cromarty to *Strome Ferry* and the Kyle of Lochalsh, where steamers start for *Stornoway* in Lewis, and *Portree* in Skye. From Dumbarton and Stirling lines run to *Oban*, the yachting centre on the west coast, to *Fort William* and *Mallaig*, a port for Stornoway.

Aberdeen is the largest city in the highland region. It has a university and is a great focus of routes. Its granite, fishing, and motor-boat industries employ many hands. Up the Dee valley is the royal castle of *Balmoral*.

QUESTIONS AND EXERCISES

1. What traces of ice-action exist in Great Britain? Which do you consider most important, and why?

2. Explain the geography which accounts for the history of the Anglo-Scottish border.

3. Which parts of the Highlands are most nearly like the Lowlands in economic development? Give reasons.

4. Describe the route you would take to get to (*a*) Stornoway, or (*b*) Thurso, or (*c*) Oban, from London.

IV.—IRELAND

CHAPTER XXXVI

IRELAND—I. GENERAL SURVEY

IRELAND is a little larger than Scotland, but its population is a little less than that of Scotland, and is much more evenly distributed. Ireland is mainly an agricultural country. She has no great coalfields, and no great industries except in the north-east. So there is no concentration of population within rich industrial areas as is the case both in England and Wales and Scotland.

Between Ireland and Britain is a channel which is very much deeper on the average than the North Sea—especially in the North Channel. The shortest ferry-crossing is by way of this channel (Stranraer-Larne, thirty-six miles); but the most popular crossings are Holyhead-Kingstown, fifty-seven miles (L.N.W.R. route); and Fishguard-Rosslare, fifty-four miles (G.W.R. route).

Surface Relief and Drainage.—Ireland is mainly a great limestone plain, partly surrounded by detached mountain masses, which lie chiefly to the north and the south. So that except for a wide gap between the Wicklow Mountains and the Mourne Mountains, the traveller approaching Ireland from any direction sees it as a hilly or mountainous land.

The geological map clearly reveals the former connection of Ireland with Britain. The mountains of Donegal are continuations of the highlands of Scotland; so are those of Mayo and Connemara. The volcanic Antrim plateau is part of the same area as the volcanic islands of the Inner Hebrides; and the basalt columns of the Giant's Causeway resemble those of Fingal's Cave in the Island of Staffa. The Mourne Mountains are prolongations of the southern uplands of Scotland; the mountains of Leinster resemble those of Wales; and the Old Red Sandstone ridges of the south-west are part of the same ancient system as the mountains of the south-western Peninsula and Brittany. The Midland Plain of England, which is a continuation of the Great Plain of Europe, is farther continued by way of the Dublin Gate into the Central Plain of Ireland.

The glacial epoch has left many traces in the Ireland of to-day. Over broad areas are thick layers of boulder clay, especially on the limestone of the Central Plain. Round-backed elongated hills of glacial débris, known as *drumlins*, occur in large numbers; they are usually well cultivated. Ridges of gravel, known as *eskers*, are other evidences left by the retreating ice. "They are covered with grass and run like walls across the country roads, often being carried along their crests on account of the dry routes thus obtained."—*Professor Grenville Cole.*

The mountain masses of the north are the Donegal Mountains, the Sperrin Mountains, the volcanic Antrim Plateau and the Mourne Mountains. Between the Donegal and Sperrin masses is the valley of the Foyle, terminating in a wide, almost land-locked estuary with *Londonderry* at its head, and *Moville*, the port of call for Canadian liners, near its entrance. Lough Swilly is another fine harbour used as a shelter by the British navy. Between the Sperrin Mountains and the Antrim Plateau lies the Bann Valley, and the faulted basin of Lough Neagh, the largest lake in the British Isles, whose surface is only about forty-eight feet above sea-level. Between the Antrim Plateau and the Mourne Mountains is the Lagan Basin with its wide drowned estuary of Belfast Lough; *Belfast* stands at the head of the estuary and *Carrickfergus* nearer its entrance.

The mountains of the south differ considerably in structure and appearance from those of the north. The southern mountains consist mainly of parallel ridges of Old Red Sandstone with intervening valleys of shale and limestone. North-east of the highest ridge, Macgillycuddy's Reeks, are the famous Lakes of Killarney, above which rises Carrantuohill (3414 feet), the highest peak in Ireland. Other ridges worthy of note are the Galtee Mountains and the Knockmealdown Mountains farther east.

The Leinster Range (Wicklow Mountains) in the south-east is a granite mass which offers violent contrasts to the parallel sandstone ridges of the south-west. From it the *Liffey* flows westward, and curves eastward round the northern base of the mountains to Dublin Bay, with *Dublin* at its head, and *Kingstown* as an outport. The *Slaney* runs southward into Wexford Harbour, with *Wexford* as port and *Rosslare* as outport. The *Barrow* rises in the east-central plain and runs due south, joined by the *Nore* from the Slieve Bloom and by the *Suir* from the west.

The parallelism of ridges in the south-west results in a remarkable parallelism of rivers—*Bandon*, *Lee*, *Blackwater* and *Suir*, whose courses provide many instances of river-capture (see p. 239). *Cork* stands at the head of the estuary of the Lee; and *Queenstown*, its outport, has been built on Great Island lower down the harbour. In the far south-west the river valleys have been invaded by the sea as a result of subsidence, and the great *rias* of Dingle Bay, Kenmare River, Bantry Bay, and Dunmanus Bay has been formed, together with many islands, of which Valencia Island, the cable terminus, and Cape Clear Island, with a famous lighthouse, are best known.

The western mountains consist chiefly of the *Mountains of Mayo* (Nephin Beg) and the Connemara Mountains—two masses separated by the gap of Clew Bay and *Westport*. At the foot of them, to the east, lies the great lake-chain of *Conn*, *Cara*, *Mask* and *Corrib*, whose outlet is at the port of *Galway* on Galway Bay. The cliffs of Achill Head, on Achill Island, rise to 2000 feet.

Between the mountains of the west and those of the north-west is the great breach of Sligo and Donegal Bays, with the

River Erne and its lake-chain draining to the latter through the county of Fermanagh.

The Central Plain is largely the basin of the Shannon (see p. 9). It consists mainly of limestone, from above which the millstone grit and the coal measures have been removed by denudation. Here and there detached blocks of millstone grit still rise above the plain. In the hollows of the limestone bogs have accumulated. The limestone basin is floored with boulder clay which holds up the water. Marsh plants, especially sphagnum moss, gradually filled up these shallow lakes with decaying vegetable matter until a bog of soft slimy mud was formed—green and treacherous. Later the bog became firmer, and finally dry peat land, where peat can be dug. The Central Plain contains bogs in all stages of development. The biggest bog is the Bog of Allen; other extensive bogs occur in Western Ireland, especially in Mayo.

Upland bogs occur in hollows on hillsides where water is naturally retained. In some cases such upland bogs overflow and a slow avalanche of mud descends into the valley, burying beneath it farms and villages. Bog-slides occur chiefly after periods of exceptionally heavy rainfall.

The peat from old boglands provides fuel—an important consideration in a country that is almost without coal. Bog-oak ornaments, pipes and trinkets are made from the ancient tree-trunks found in the bogs, and are sold to tourists in the shops of the towns and villages.

Climate and Productions.—The climate of Ireland is wetter and milder than that of England in the same latitude. It lies to windward of Britain, and its broken mountainous rim on the west is the first highland athwart the track of the wet Atlantic westerlies. The heaviest rainfall occurs in the mountains of Kerry. *Valencia's* rainfall exceeds forty-five inches annually; that of *Dublin* is less than twenty-nine inches, for Dublin is on the lee side of the island.

Range of temperature is less than in Britain. The least range (16° F.) is experienced in the south-west; the greatest in the

FIG. 80.—IRELAND: RELIEF AND ROUTES

east of the Central Plain around the Dublin Gate. Ireland has, on the whole, less sunshine than England. The sunniest part of Ireland, the south-east, has from 1500 to 1600 hours annually; the south-east of England, however, has from 1600 to 1800 hours of sunshine annually.

The widely-distributed rainfall gives Ireland a freshness of greenery that has earned for it the name of "The Emerald Isle."

Ireland is poor in coal. She has few mineral ores. Hence she can never become a great manufacturing country. Her future prosperity must depend on her agriculture and stock-rearing.

The rearing of cattle, horses and pigs is of far greater importance than agriculture in a country that has so much land unfit for the plough, and so heavy a rainfall. Animals can live outdoors all the year round owing to the mildness of the climate, and there is always an abundance of natural food for them. But in spite of Ireland's advantages as a stock-breeding country, they have not as yet been fully utilised.

The most important cattle-rearing regions are in Kildare, Armagh, Dublin, Londonderry, Limerick, Kilkenny and Meath, which supply Britain with numbers of store cattle. Irish horses are famous—especially hunters and race-horses.

Dairy-farming is a very important industry. The great co-operative movement of recent years has done much to restore the industry to prosperity after its serious decline under competition from Denmark. In 1916 there were over 400 dairy societies representing some 50,000 dairy farmers, owning their creameries for the scientific production of cheese and butter on a big scale.

Pigs thrive on the waste of dairy farms. Pig-breeding in Ireland is important, and Irish bacon and ham command good prices in the world's markets. *Londonderry*, *Belfast* and *Ballymena* in the north; and *Limerick*, *Cork*, *Waterford* and *Tralee* in the south, are famous for bacon and hams. Over 25 per cent. of Ireland's total export trade is in cattle and dairy produce; and the bulk of it is carried on with Britain.

Oats and barley are the chief grains: the rainfall is generally too heavy for wheat except in the eastern regions. Root crops thrive amazingly and potatoes are raised on a large scale. Ulster is the richest agricultural region—especially around Lough Neagh. In Ulster, too, are the chief flax fields. Expert opinion states that under proper cultivation Ireland is capable of

FIG. 81.—IRELAND: VEGETATION AND CULTIVATION

producing all the flax required by the linen industry of Great Britain and Ireland.

Irish Coalfields, Peat and other Minerals.—Ireland consumes 4,500,000 tons of coal and from 5,000,000 to 6,000,000 tons of peat every year. Of the coal she can produce only 92,000 tons annually; the rest she must import. A great deal comes from the Ayrshire coalfield, or from the English and Welsh coalfields. Yet recent investigations prove that Ireland has a probable total coal reserve of 228,436,000 metric tons; and that under proper direction the annual output should easily reach 500,000 tons annually.

The chief coalfield is the *Leinster* or *Kilkenny* coalfield which extends into Queen's County and Carlow also. It produces fine anthracite equal to any in Britain. Other coalfields are: (1) *Ballycastle coalfield* in Antrim; (2) *Coal Island* in Tyrone; (3) *Arigna coalfield* on both sides of Lough Allen; and (4) *Slievardach* or *Tipperary coalfield.* The first two of these lie in the same great trough as the coalfields of the Scottish Rift Valley.

There are many other deposits, especially in the south-west; but the seams are too thin and the coal too poor to render working profitable.

Peat compensates for lack of coal; about a seventh of the whole of Ireland (over 3,000,000 acres) is productive of good peat; and peat-cutting and peat-drying are important rural occupations.

Copper is mined in the Wicklow Hills and in County Cork. *Lead* is obtained at Glendalough, in Wicklow, and at Ballysadare, in Sligo. *Zinc* is mined in Tipperary. *Building-stones*—serpentines, marbles and granite occur in many mountain masses. Black marble from Galway and Kilkenny; green marble from Connemara and Galway; and red marble from Fermoy are famous.

Some *iron* ore is mined in Tyrone, Leitrim and Kilkenny, and at various places in the Antrim Plateau, whence *bauxite*, used for extracting aluminium, is also obtained.

Population.—The population of Ireland is barely half what it was in 1841. Emigration has played an important part in its decline. Between 1851 and 1916, the total number of emigrants from Ireland was 4,317,781. Since 1853 the average yearly emigration is estimated at 66,000. Many Irish have emigrated to America, especially to the United States, whose 1910 census record that of the 2,500,000 persons of British birth resident there, more than half were Irish. In many parts of Ireland, especially in the west, the land is so poor that it cannot adequately support its population. Peasants live in great poverty, and seek salvation in emigration rather than eke out a miserable existence at home. But in other regions the land can be made to support more than its present population if full advantage is taken of its possibilities and scientific farming becomes the rule.

The only great centres of dense population are Dublin and Belfast. Elsewhere the population is fairly evenly distributed.

Railways.—Dublin, the metropolitan city of Ireland, is the natural focus of routes, because it is the natural gateway of traffic from Britain and Western Europe.

There are three main trunk lines:

(1) *Great Northern*, from Dublin to Belfast, *via* Drogheda, Dundalk, Newry, Portadown, Lurgan and Lisburn; with branches to Londonderry, Enniskillen, Newry, Clones and Armagh.

(2) *Midland and Great Western*, from Dublin to Galway, *via* Maynooth, Mullingar and Athlone, and on to Clifden, the great wireless station on the Atlantic. An important branch runs from Mullingar, *via* Longford, to Sligo. From Athlone another branch serves the little ports on Clew Bay.

(3) *Great Southern and Western*, the biggest Irish railway, from Dublin to Cork and Queenstown, *via* Kildare, Maryborough and Mallow; with branches to Tipperary and Limerick, Waterford and Wexford, and to the Lakes of Killarney.

Canals.—Ireland is admirably suited to the construction of canals; she has several, but like English canals they have partly decayed, and are not as important as they should be in the scheme of inland transport.

The *Shannon Canal System* is the most important. It consists of:

(*a*) The *Royal Canal*, from Dublin to Richmond Harbour, on the Shannon. It runs parallel with the Midland and Great Western as far as Mullingar.

(*b*) The *Grand Canal*, from Dublin, *via* Tullamore, across the Shannon to Ballinasloe on the Suck. It has a branch from Robertstown, south to Athy.

(*c*) The *Shannon Navigation*, from Shannon Harbour to Limerick, which avoids the rapids in the river.

The *Northern Canal System* includes the following:

(*a*) *Ulster Canal*, linking the Lough Erne system with the Blackwater and Lough Neagh, *via* Clones and Monaghan.

(*b*) *Lagan Canal*, from Lough Neagh to Lisburn and Belfast.

(*c*) *Newry Navigation and Ship Canal* linking the Bann with Carlingford Lough, *via* Newry.

QUESTIONS AND EXERCISES

1. Draw a curve to show the decline in output from Irish coalfields during the period 1854–1918.

Year.	Tons.	Year.	Tons.
1854 .	148,750	1911 .	84,564
1864 .	125,000	1912 .	90,307
1874 .	139,213	1913 .	82,521
1884 .	122,431	1914 .	92,400
1894 .	112,604	1915 .	84,557
1904 .	105,637	1916 .	89,833
1909 .	89,392	1917 .	95,646
1910 .	79,802	1918 .	92,001

2. What do you gather from the following table? What causes are responsible for it?

Year.	Population of Ireland.
1841 .	8,175,124
1861 .	5,798,564
1881 .	5,174,836
1901 .	4,458,775
1911 .	4,390,219

3. Explain why Ireland can never become a great manufacturing country. In what natural advantages does the future prosperity lie?

4. Draw a map of the Shannon Basin showing its canal connections with other river systems and the coast.

CHAPTER XXXVII

IRELAND—II. REGIONS, TOWNS AND INDUSTRIES

For the purpose of more detailed study we will divide Ireland into (1) Northern Ireland; (2) Eastern Ireland; (3) the Central Plain; (4) Southern Ireland; and (5) the Western Highlands.

[These are not, strictly speaking, natural regions; neither are they political divisions.]

Northern Ireland.—Northern Ireland may be divided into (*a*) the Antrim Plateau of basalt above the chalk; (*b*) the old crystalline masses of the north-west; (*c*) the continuation of the southern uplands of Scotland in Counties Down, Armagh and Monaghan. It includes the greater part of the old province of Ulster. North-eastern Ireland is the richest, the most densely populated and the most important part of all Ireland. It is the home of the greatest Irish manufacturing industry, and it contains some of the richest agricultural land in the country.

Northern Ireland, especially in the north-east, raises all the flax and half the oats grown in the island. Cattle and horses are reared in the valleys and plains; sheep are reared on the hill-sides, especially in Donegal.

The chief industrial region of Ireland lies east of a line joining Londonderry with Newry. *Linen-weaving* is the chief industry. Home-grown flax, Scottish coal and machinery, pure water for washing and bleaching, and cheap labour are the main factors. The largest factories are in *Belfast* and *Londonderry*; but the industry gives employment to numbers of other towns and villages in the north-east of Ireland, *e.g. Ballymena*, *Coleraine*, *Limavady*, *Ballymoney*, *Dundalk*, *Newtownards*, *Donaghadee* and *Drogheda*.

Londonderry specialises in shirts; *Lisburn* in damasks; *Lurgan* and *Portadown* in cambric and lawn; and *Armagh* and *Monaghan* in brown holland.

Belfast, at the head of Belfast Lough, is the centre of a great shipbuilding industry, and builds some of the largest liners afloat. Coal from the Ayr coalfield, local iron, supplemented by iron from the Lanark coalfield and from the Furness District, and a fine harbour all contribute to the success of the industry. Belfast also has enormous linen factories, breweries, distilleries, potteries, tobacco manufactures and rope works. Women work in the linen factories; men in the shipyards.

In Donegal there is a " domestic industry " in the manufacture of homespuns (*cf.* Western Hebrides of Scotland), and the products find a ready market in England.

Ballycastle, in the north-east, and *Dungannon*, in Tyrone, have collieries. *Ballymena* and *Glenarm* have ores of iron and aluminium, most of which is sent to Scotland to be treated.

Portadown is a centre for fruit. Most of the county towns are market towns. *Armagh* is the seat of an archbishopric; linen goods are manufactured. Fishing is carried on from the ports of Belfast, Larne, Moville and Londonderry, and from a number of villages and towns along the coast, *e.g. Kilkeel*, Ardglass and Portrush.

Eastern Ireland.—This is the region of the Dublin Gate and includes part of the great central plain.

Dublin, at the mouth of the Liffey, on a harbour at the centre of the east coast, and opposite Holyhead, where Anglesey narrows the channel, naturally became the chief gateway into Ireland from England and the capital. It has a university and a cathedral. Roads, canals and railways converge upon it from all the regions of Ireland, and facilitate the collection of Irish produce there for distribution abroad, and the collection of foreign produce for home distribution. In these respects Dublin resembles London; moreover, it is a metropolitan type of city, where business relating to the whole of the country is done, and where all kinds of small manufactures have sprung up in spite of the fact that there are little or no local resources.

Dublin lies opposite the great industrial regions of South Lancashire and the Midlands, hence its convenience as a food-exporting centre. It is in direct communication with Holyhead, Liverpool, Fleetwood and Heysham. Its outport is *Kingstown*.

Supplies of pure water have fostered Dublin's large brewing, distilling and dyeing industries. There are also important woollen manufactures, and Irish poplins are a characteristic product.

Balbriggan, on the coast, north of Dublin, gives its name to a special kind of hosiery. The industry grew up there in 1780, and has since spread to neighbouring towns and the great linen-weaving centres.

Drogheda, on the Boyne, and *Dundalk*, on Dundalk Bay, have linen industries, *Greenore*, at the mouth of Carlingford Lough, is a ferry-town for Holyhead, and the natural port of the local linen industries and the rich agricultural lands behind it.

West of Dublin, near Kildare, is the *Curragh*, once famous as a military camp. Sheep are reared in this neighbourhood.

The Central Plain.—The physical peculiarities of the Central Plain have already been discussed (see pp. 337–39). Towns chiefly occur at confluences of the streams, at bridge points, at meeting-places of rail and canal, or road and river. Pastoral occupations are of most importance in the whole of this region. Less than a tenth of the area is under crops; oats, barley and potatoes are grown. Great numbers of cattle and pigs are reared, and dairy industries provide butter, cheese, bacon, hams and eggs for the English markets. The chief towns are naturally market towns.

The richest pastures in Ireland are in the famous "Golden Vale," between Limerick and the upper Suir.

Limerick, at the head of the Shannon estuary, and at the lowest bridge-point, is a centre for dairy produce. It cures bacon and hams; it has tanneries and makes leather for harness; it is a lace-making centre, and also manufactures fish-hooks and fishing gear. It is the outlet for the great pastoral area of the Shannon Basin.

Galway, on Galway Bay, has a splendid position, facing the Americas, and much nearer North American ports than either Liverpool or Glasgow. Yet it has declined in importance if anything. It has not become a great port of trans-Atlantic traffic, because it has no busy industrial hinterland; a scantily-populated pastoral area lies behind it. It is a small port and a fishing centre. Like *Sligo* it exports cattle and dairy produce.

Athlone, *Mullingar* and *Ballinasloe* are market centres at points where road, river, rail and canal meet. *Tullamore*, *Clonmel*, *Tipperary* and *Cashel* are market towns within the Golden Vale.

The Western Highlands. — In many respects this region resembles the Western Highlands of Scotland—in scenery, scanty population, difficulty of communication and in characteristic occupations. But many of the people live in a condition of poverty without parallel in any other rural area of the British Isles.

Cattle, horses and pigs are reared. Sheep flourish on the highlands. There are rich fisheries, but the ports are so far from big markets that fishing has not been developed to any great extent. Many of the Irish peasants of this region go to Scotland and England to work in the fields during the harvest time; others have emigrated to America, where a better chance than they could hope for at home awaits them.

The magnificent scenery of Connemara is beginning to attract tourists, who may in time give rise to "tourist industries" there, comparable with those of the Scottish highlands and Killarney.

Westport and *Newport*, on Clew Bay, and *Killala*, on Killala Bay, are small ports serving the region. *Claremorris*, in Mayo, is an important focus of routes; five railways converge upon it.

Cligden, in the far west of Galway, is a great trans-Atlantic wireless station.

Southern Ireland.—Here again pastoral industries are more important than agriculture, especially in the western half of the region. In the south-east there is much more agriculture than in the south-west; and it is in the eastern part of the Golden Vale (the Suir Basin) that wheat is most successfully grown in Ireland. Oats and barley are widely grown. Dairy-farming is everywhere important, especially in the river valleys.

Between *Carlow* and *Kilkenny* coal-mining is carried on.

The remarkable parallelism of ridge and valley lends considerable character to route-direction, the main lines of railway and the roads running east–west.

Cork, at the head of the Lee estuary, is the biggest town in Southern Ireland. It cures bacon, makes condensed milk, distils whisky, and exports great quantities of cattle, bacon, ham, cheese, butter and eggs to Britain, chiefly through Bristol. *Queenstown*, on Great Island, is its outport; it is a great port of call for mails and passengers for liners to America. Mails from England go *v a* Holyhead, Dublin, and the Great Southern and Western line to catch the mail-boats at Queenstown.

Mallow, on the Blackwater, is an important railway junction and market at the cross-roads between east and west and north and south. *Waterford* and *Wexford* export dairy produce and cattle to England. *Rosslare* is the ferry port for Fishguard on the Great Western Railway route to Ireland. *Kinsale*, *Youghal* and *Dungannon* are smaller ports and outlets for the dairy produce of the southern river valleys. *Valencia Island*, in the west, is the terminus of several Atlantic cables. *Bantry* and *Berehaven* are naval stations.

Bagenalstown, on the Barrow, is a railway centre with trade in granite, slate and sandstone from the Leinster ranges and the Wicklow Hills. Copper and pyrites are mined in the *Vale of Avoca*, which is also famous for its scenery.

QUESTIONS AND EXERCISES

1. Compare and contrast the river courses of Southern Ireland with those of the Weald.

2. Explain the geographical importance of Dublin, Belfast, Limerick, Cork and Londonderry. Illustrate by sketch maps.

3. Discuss fully any *one* of the following:
   (*a*) Ireland's decline in population.
   (*b*) The importance of the Irish dairy industry.
   (*c*) The sites of towns in the Central Plain.

4. Draw a sketch map showing the main railways of Ireland and their connections with British railway systems.

5. Explain why the western parts of Ireland are unimportant in spite of their splendid natural advantages.

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